From Department of Global Public Health
Karolinska Institutet, Stockholm, Sweden

TREATING ALCOHOL USE DISORDER ON THE INTERNET

Magnus Johansson

Karolinska Institutet

Stockholm 2020

Cover illustrated by Li-Lo Sahlberg (http://gallerililo.info).
Published by Karolinska Institutet.
Printed by Universitetsservice US AB

ISBN 978-91-7831-904-6

TREATING ALCOHOL USE DISORDER ON THE INTERNET

THESIS FOR DOCTORAL DEGREE (Ph.D.)

By

Magnus Johansson

Principal Supervisor:
Professor Sven Andreasson
Karolinska Institutet
Department of Global Public Health

Co-supervisor(s):
Dr. Ulric Hermansson
Karolinska Institutet
Department of Clinical Neuroscience
Centre for Psychiatric Research

Associate professor Anne H Berman
Karolinska Institutet
Department of Clinical Neuroscience
Centre for Psychiatric Research

Dr. Christina Sinadinovic
Karolinska Institutet
Department of Clinical Neuroscience
Centre for Psychiatric Research

Opponent:
Professor Katie Witkiewitz
University of New Mexico
Department of Psychology

Examination Board:
Professor Anna Sarkadi
Uppsala University
Department of Public Health and Caring Sciences
Social medicine/CHAP

Professor Per Nilsen
Linköping University
Department of Health, Medicine
and Caring Sciences (HMV)
Division of Society and Health (SH)

Professor Rosaria Galanti
Karolinska Institutet
Department of Global Public Health

People seem to have an impressive capacity to change themselves if you believe in them, if you tell them they can and give them some help in doing so.

William R Miller

Abstract

Background: Alcohol use disorders are highly prevalent worldwide, but most of the people with such disorders are never treated. Internet interventions are effective in reducing alcohol consumption and could help overcome some of the reasons for why people do not seek or receive treatment. The aim of this thesis was to study if internet alcohol programs are an effective treatment option for people with alcohol use disorder.

Method: Internet Cognitive Behavioural Therapy (ICBT) alcohol programs were studied in one naturalistic study, one randomized controlled trail, one randomized controlled non-inferiority trail and one qualitative content analysis. Study I investigated user characteristics, intervention use patterns, and variables associated with reductions in alcohol use, among anonymous individuals with hazardous alcohol use who signed up for an ICBT self-help program. Study II was a randomized controlled trial with anonymous users with likely alcohol dependence (n =1169), comparing guided ICBT program and self-help ICBT program with information. Study III was a randomized controlled non-inferiority trail comparing guided ICBT to face-to-face CBT at a specialized clinic among patients diagnosed with alcohol use disorder (n = 301). Study IV investigated the differences between internet treatment and face-to-face as perceived by twelve therapists working with internet-based treatment for alcohol or cannabis use disorders within different programs, interviewed in three focus group interviews.

Results: In Study I, 4165 individuals signed up during two years. Half of the participants were women, the mean age was 42 years, 82 % had high (>15) total score on the Alcohol Use Disorders Identification Test, 74% had symptoms of anxiety and 90% were in the contemplation stage of readiness to change. Scoring higher on baseline readiness, completing the program, and accessing other support predicted low-risk drinking at follow-up after the program. In Study II, no significant differences were found in weekly alcohol consumption between the self-help and the therapist-guided ICBT groups at three months, between the self-help group and the control group at three months or between any of the groups at six months. At three months follow-up a significant difference was identified between the therapist guided and control group in weekly alcohol consumption (difference = -3.84, 95 CI = -6.53 to -1.16, t = 2.81, p = 0.005). The difference in alcohol consumption between the internet and the face-to-face CBT group in Study III was non-inferior according to the prespecified limit of five standard drinks, in the intention-to-treat analysis of data from six months follow-up and in most secondary outcomes at three- and six-months. The analysis in Study IV revealed five themes in the differences between internet-based and face-to-face treatment: communication, anonymity, time, presence and focus. Treatment online in written and asynchronous form creates something qualitatively different from regular face-to-face meetings between patients and therapists.

Conclusions: A publicly available web-based program for problematic alcohol use attracted users with considerable alcohol and health-related problems. A web-based ICBT program with therapist guidance was not found to be more effective than the same program as self-help in reducing alcohol consumption or other alcohol-related outcomes. An ICBT program with therapist guidance might be more effective in the short run than information. Internet CBT was not inferior to face-to-face CBT in reducing alcohol consumption among patients with alcohol use disorder. There are important differences between conducting internet-based and face-to-face treatment. Different aspects of the working alliance seem to be important on the internet compared to face-to-face. Internet alcohol interventions can be an effective treatment alternative for alcohol use disorder.

LIST OF SCIENTIFIC PAPERS

I. **Johansson, M.**, Sinadinovic, K., Hammarberg, A., Sundström, C., Hermansson, U., Andreasson, S., & Berman, A. H. (2017). Web-based self-help for problematic alcohol use: a large naturalistic study. *International journal of behavioral medicine*, *24*(5), 749-759.

II. **Johansson, M.**, Berman, A. H., Sinadinovic, K., Lindner, P., Hermansson, U., & Andreasson, S. (Submitted manuscript). Web-Based treatment of alcohol dependence: a randomized controlled trial.

III. **Johansson, M.**, Sinadinovic, K., Gajecki, M., Lindner, P., Berman, A. H., Hermansson, U., & Andreasson, S. (Submitted manuscript). Internet-based therapy vs. face-to-face therapy for alcohol use disorder, a randomized controlled non-inferiority trial.

IV. Ekström, V., **Johansson, M.** (2019). Sort of a nice distance: a qualitative study of the experiences of therapists working with internet-based treatment of problematic substance use. *Addiction science & clinical practice*, 14(1), 1-11.

Contents

List of abbreviations

AA	Alcoholics Anonymous
AUDIT	Alcohol Use Disorders Identification Test
BCT	Behaviour Change Technique
BSCT	Behavioural Self-Control Training
CBT	Cognitive Behavioural Therapy
CDT	Carbohydrate-Deficient Transferrin
CM	Contingency Management
CRA	Community Reinforcement Approach
DSM	Diagnostic and Statistical Manuals of Mental Disorders
EQ-5D	EuroQol-5 dimension
GAD-7	Generalized Anxiety Disorder Assessment–7 Items
HADS	Hospital Anxiety and Depression Scale
ICBT	Internet Cognitive Behavioural Therapy
ICD	International Classification of Diseases
MADRS-S	Montgomery Asberg Depression Rating Scale – Self Rated
MET	Motivational Enhancement Therapy
MI	Motivational Interviewing
MM	Moderation Management
RCQ	Readiness to Change Questionnaire
RCT	Randomised Controlled Trial
SBI	Screening and Brief interventions
SD	Standard Deviation
SRS	Session Rating Scale
TAU	Treatment as Usual
TLFB	Timeline Follow Back
TSF	Twelve Step Facilitation
VAS	Visual Analogue Scale
WHO	World Health Organisation
WHOQOL	World Health Organization Quality of Life Scale-abbreviated version

1 Alcohol use and its consequences

1.1 The consumption of alcohol

Alcohol is the most widely used psychoactive substance in the world. In this thesis alcoholic beverages that contain the chemical substance ethanol (C_2H_5OH), like beer, wine or liquor, are referred to as alcohol. The total alcohol consumption in the world's adult population (over 15 years of age) was 6.4 litres of pure alcohol per capita in 2016. About 2.35 billion people are current drinkers, e.g. consumed alcohol in the previous 12-months. Men drink more than women. The proportions of current drinkers are 53.7% among males and 32.4 % among women in the world's adult population. The average consumption among current drinkers was 19.4 litres of pure alcohol for men and 7.0 litres for women. Alcohol consumption varies a lot over the world. High national levels of consumption are primarily found in Western Europe, Russia, parts of the former Soviet Union and the Americas. Other parts of the world like India and the Middle East have lower number of drinkers and lower consumption in the population (WHO 2018).

Table 1: Alcohol consumption in Sweden, Europe and the world 2016

		All		Among current drinkers	
	Current drinkers (%)	**APC (litres)**	**HED (%)**	**APC (litres)**	**HED (%)**
Sweden	62.0	9.2	28.8	12.5	38.3
Europe	59.9	9.8	26.4	17.2	42.6
World	43.0	6.4	18.2	15.1	39.5

APC: average per capita alcohol consumption, HED: Heavy episodic drinking means consuming more than 60 grams of alcohol (the equivalent of five standard drinks in Sweden), at least once during the last month.

In Sweden more people drink alcohol, but the average alcohol per capita consumption among drinkers is slightly lower compared to Europe and the whole world. Alcohol consumption in Sweden is higher than it was in the 1990's. But in recent years there has been a decrease in consumption, especially among young people (CAN 2017). Most drinkers in Sweden consume small or moderate amounts of alcohol while a small group of heavy drinkers consume a lot (Raninen et al. 2013).

1.2 Effects of drinking alcohol

The effects that people experience as positive when consuming alcohol usually come immediately. These might be feelings of euphoria, relaxation and joy or a sense of becoming more social, less self-critical and less worried. Some of these effects are clearly linked to the effects

of alcohol in our brains, while others are related to our expectations or the context in which the drug is used, e.g. in the sun with good friends after a hard week at work (Peele and Brodsky 2000).

1.3 Guidelines for alcohol use

Guidelines i.e. from national health agencies, are often used to quantify the level of alcohol consumption that is regarded as hazardous. Both the average alcohol consumption and how much alcohol is consumed on each separate occasion is relevant when assessing hazardous alcohol use. There is a lack of international consensus regarding guidelines for low-risk drinking (Furtwængler and De Visser 2013). Sweden has no official guidelines but a definition suggested in a report (Andréasson and Allebeck 2005) has often been used. The recommendation for weekly alcohol consumption is to not drink more than fourteen standard glasses per week if you are a man and not more than nine standard glasses per week if you are a woman. The reader should keep in mind that a standard drink of alcohol is defined as containing twelve grams of alcohol in Sweden. One standard drink equals approximately one small glass of wine (10-15 cl), one small beer (33 cl), one shot or one cocktail. A bottle of wine (75 cl) equals six standard drinks. The recommendation is also not to binge drink, which is defined as four or more standard drinks for women and five or more standard drinks for men on the same occasion. In 2016, 13 % of men and nine percent of women in Sweden drank above these recommendations (Guttormsson and Gröndahl 2017). More recent guidelines developed for the region of Stockholm consider under 10 drinks and fewer than four on each occasion, for both men and women as low risk (Allebeck et al. 2018). The guidelines are based on epidemiological studies pointing to lower risk of harm under these limits (Rehm, Room, and Taylor 2008).

1.4 Hazardous alcohol use

When alcohol is consumed in bigger quantities more negative consequences can arise. Heavy episodic use or binge drinking increase the risk of injuries and death from different types of accidents or social and relationship problems. This is connected to changes in psychomotor abilities, cognitive functions and behaviour when an individual is intoxicated (Field et al. 2010). The day after heavy alcohol consumption there are more negative effects like hangover, anxiety or withdrawal symptoms. Cognitive functioning and the ability to perform advanced tasks like driving are reduced the day after heavy drinking (Gunn et al. 2018). When larger amounts of alcohol are used regularly over a longer time, negative health consequences become more likely. There is no level of alcohol consumption that can be considered to be entirely risk-free (Wood et al. 2018).

The term hazardous alcohol use describes a level of alcohol use that significantly increases the risks associated with alcohol. According to World Health Organizations (WHO) most recent diagnostic manual it refers to a pattern of alcohol use that appreciably increases the risk of harmful physical or mental health consequences to the user or to others to an extent

that warrants attention and advice from health professionals (Saunders et al. 2019). An-other way of defining hazardous or at-risk alcohol use is through the Alcohol Use Disorders Identification Test (AUDIT). A score of 8-15 for men and 6-15 for women on the AUDIT indicates hazardous use (Saunders 1993). The proportion of Swedes, between 17-80 years old that had such use was 15% among men and 12% among women in 2014 (Kallmen et al. 2015).

1.5 Harmful alcohol use

There are three main ways in which alcohol consumption causes harm to humans (WHO 2018):

1) Alcohol has toxic effects on organs and tissue which can lead to somatic disease.
2) Binge drinking episodes can lead to intoxication with impairment of physical coordination, level of consciousness, perception, cognition, affect and behaviour which can lead to accidents, injuries or social problems.
3) Alcohol use disorder or dependence where self-control over drinking behaviour is impaired which can lead to stigma and social problems.

Alcohol reaches all organs and affects virtually the entire body. When both detrimental and possible beneficial health effects of alcohol consumption are incorporated in the estimate; three million deaths (5.3% of all, 3.8% of female and 12.2% of male deaths) are attributed to alcohol consumption globally. Alcohol use is ranked as the seventh leading risk factor for premature death and disability. The effects of alcohol consumption on mortality are greater than those of major diseases like tuberculosis (2.3%) and diabetes (2.8%) (WHO 2018). A register study in Sweden, Finland and Denmark show that the mortality associated with alcohol use disorders can lead to a reduction in life expectancy of more than 20 years from the average in the population (Westman et al. 2015). But most alcohol related harms are non-fatal and mortality rates tend to underestimate the impact. Disability adjusted life years (DALY) is a term used to refer to a combination of years of life lost, premature death, and years lived with disability, which together provide a more accurate method of calculating the total disease burden from alcohol (Murray et al. 2012). Globally, 5.1 % of DALYs (2.2% among women and 7.6% among males) were attributable to alcohol 2016 (WHO 2018).

Alcohol is causally linked to more than 200 diseases and there are dose–response relationships between alcohol consumption and many major diseases, i.e. the higher average quantity of alcohol consumed, the higher the likelihood of developing a disease. (Rehm 2010; Rehm 2017). A diagnosed alcohol use disorder is not necessary to be affected by alcohol related illnesses; even moderate drinkers are affected. Earlier research has suggested that moderate alcohol consumption might protect against some diseases, cardiovascular disease in particular, but this claim has been called into question in recent years (Holmes et al. 2014; Stockwell et al. 2016).

Alcohol can also affect other health problems. For example, an estimated 4.2% of all cancer deaths globally were attributable to alcohol consumption. Alcohol consumption causes death

and disability early in life. It was the leading risk factor globally for both deaths and DALYs among those aged 15–49 years, causing 8.9% of attributable DALYs (GBD 2016 Alcohol Collaborators et al. 2018). Binge drinking is linked to certain categories of alcohol-related harm such as injuries, traffic accidents, homicide, suicide and injuries (Rehm et al. 2009). Individuals with an alcohol use disorder are estimated to account for half of all alcohol-related harm (Rehm et al. 2010). For these individuals' social problems in family relationships or at work often develop.

1.6 Harm to others

In recent years the harm done by alcohol consumption to other individuals than the drinker has gained increased attention (Karriker-Jaffe et al. 2017). In Sweden 18% of women and 9% of men report having been affected negatively by the alcohol use of someone close to them (Ramstedt et al. 2015). Having an individual with problematic alcohol use in one's life is connected to reduced personal wellbeing and poorer health status (Casswell et al. 2011; Livingston et al. 2010). Female partners of male individuals with hazardous alcohol use show high levels of psychological distress (Tempier et al. 2006). Children who grow up with a parent with alcohol problems have a higher risk of developing psychological and behavioural problems (Velleman and Templeton 2016). In Sweden 4% of children are estimated to have at least one parent with alcohol use disorder (Raninen et al. 2016).

1.7 Alcohol use disorders

Harmful alcohol consumption that causes health problems described above is a diagnosis in ICD-10 and 11. But when does an individual's use of alcohol become a disorder in itself? Several terms have been used for alcohol use disorders over the years; alcoholism, dependence, addiction, misuse and abuse are some examples used both by researchers and in everyday language. What alcohol problems are called represent different levels of problem but also different perspectives from which the phenomenon can be viewed. The American physician Benjamin Rush was the first to describe alcohol dependence as a disorder in 1797. The Swedish physician Magnus Huss systematically described the physical and mental effects and the addictive potential of alcohol use observed in the individual, and named the disease "alcoholismus" in 1849. In 1960 Jellinek defined alcoholism as any use of alcoholic beverages that causes damage to the individual, to society, or both. Edward and Gross proposed seven criteria in 1976 which was the first clear definition of the alcohol dependence syndrome. The description was revised by Edwards in 1986, suggesting two main features of alcohol dependence; impaired control and withdrawal or tolerance as biological consequences. (Li et al. 2007).

1.8 Diagnostic criteria

Diagnostic criteria for alcohol use disorder have been developed by observing symptoms typical of the patients. There are no tests that can be used to determine whether a person has got the disorder or not, although different biological markers can be used as part of an

assessment. Today, both the International Classification of Diseases (ICD) of the WHO and the Diagnostic and Statistical Manuals of Mental Disorders (DSM) of the American Psychiatric Association are used in healthcare and in research. The systems contain similar criteria (see table 2). ICD is a classification list of diseases in general and DSM is focused specifically on mental health and psychiatry. Both systems have gone through changes in recent years. The ICD specifies two diagnoses for problematic alcohol use: Harmful (pattern of) alcohol use, and Alcohol Dependence (syndrome). The diagnosis of harmful use is used when the alcohol use actually has caused some kind of damage to the mental or physical health of the user. The older definition of alcohol dependence in DSM-4 was similar to the definition in ICD-10. In the update to DSM-5, the criteria from the two diagnoses abuse and dependence were combined into alcohol use disorder.

1.9 Prevalence of alcohol use disorders

An estimated 237 million men and 46 million women had alcohol use disorders globally in 2016. Europe had the highest prevalence of alcohol use disorders, with 14.8% among men and 3.5% among women. The same year 2.6% of people were estimated to have alcohol dependence globally and 3.7% in Europe (WHO 2018). According to the National Epidemiologic Survey on Alcohol and Related Conditions III (NESARC-III), where a representative sample of US adults (n = 36 309) were interviewed face-to-face, the twelve-month prevalence of alcohol use disorder according to DSM-5 was 13.9% (17.6% among men and 10.4% among women) and lifetime prevalence 29.1% (36.0% among men and 22.7% among women) (Grant et al. 2015). In Sweden, 4.0% (4.9% of men and 3.2% of women) of the adult population have been estimated to fulfil the diagnostic criteria for alcohol dependence according to DSM-4. A majority of these, around 75 %, have a mild to moderate form of dependence; with three or four criteria for dependence, while a minority, circa 25 %, have more severe dependence, with five to seven criteria (Andreasson et al. 2013).

Table 2. Diagnostic Criteria for Alcohol Use Disorder and Alcohol Dependence and in DSM-5, ICD-10 and ICD-11

DSM-5 Alcohol Use Disorder	ICD-10 Alcohol Dependence Syndrome	ICD-11 Alcohol Dependence
At least two criteria within the last year. Categorized according to severity: 2-3 mild, 4-5 moderate, 6 or more severe	Three or more criteria occurred together for at least one month or repeatedly within a twelve-month period.	Two or three features evident over at least 12 months, or if alcohol use is continuous for at least 1 month.
Craving, strong desire or urge to use alcohol.	Strong desire or compulsion to use alcohol.	**Impaired control** in onset, level, circumstances or termination of alcohol use, often (but not always) with a subjective sensation of urge or craving.
Use alcohol in larger amounts or over longer period than intended.	Difficulties in controlling onset, termination, or level of alcohol use.	
Persistent desire or unsuccessful efforts to cut down or control alcohol use.		
Important social, occupational or recreational activities are given up or reduced because of alcohol use.	Progressive neglect of alternative pleasures responsibilities or interests because of alcohol use, or time spent on obtaining, drinking or recover from alcohol.	**Increasing priority** in life given to alcohol use over other interests or enjoyments, daily activities, responsibilities, or health or personal care. Making other life-areas peripheral, often despite the occurrence of problems.
Alcohol use results in failure to fulfil obligations at work, school, or home (e.g. repeated absences or poor performance)		
A great deal of time is spent in activities necessary to obtain alcohol, use alcohol, or recover from its effects		
Continued alcohol use despite knowledge of physical or psychological problem caused or by alcohol.	Continued alcohol use despite clear evidence of harmful consequences.	
Continued alcohol use despite social or interpersonal problems caused or worsened by alcohol.		
Recurrent alcohol use in situations in which it is physically hazardous		
Tolerance	Tolerance	**Physiological features** manifested by tolerance, withdrawal or repeated use to prevent withdrawal.
Withdrawal	Withdrawal	

Tolerance: a need for increased amounts of alcohol to achieve intoxication (or desired effect) or less effect by the same amount of alcohol. *Withdrawal*: withdrawal symptoms characteristic for alcohol (e.g. shakiness, restlessness, nausea, sweating, a racing heart, or a seizure) when reducing or stopping alcohol use, or use of alcohol (or related substance) to relieve or avoid such symptoms.

1.10 Other terms used for problematic alcohol use

1.10.1 Alcohol abuse

Earlier diagnostic classification systems have tried to differentiate between use, abuse and dependence of alcohol. The DSM-4 made a distinction between alcohol abuse and alcohol dependence, where abuse primarily indicated use causing social harm. According to DSM-4 alcohol abuse refers to repeated adverse social and legal consequences caused by drinking, like failure to manage work, school or family responsibilities or driving under the influence of alcohol. Analysis with item response theory have later showed that the criteria of abuse and dependence measured one dimension rather than two. People suffering from alcohol abuse have been considered to be more able to return to a non-problematic alcohol use, while alcohol dependence generally have been considered to be more persistent. In Sweden the term alcohol abuse is still used within social services and among some researchers, as an alternative to using medical diagnosis. But the term is connected to stigmatizing attitudes. A vignette study among trained mental health professionals showed that they agreed more with the notion that the individual described was personally culpable and that punitive measures should be taken, when the term “substance abuser" was used compared to when the term "substance use disorder" (Kelly and Westerhoff 2010). According to a consensus statement from research journals within the alcohol field abuse and abuser or equivalent words in other languages should in general be avoided (Saitz 2016).

1.10.2 Alcoholism

Alcoholism is an older term rarely used in current research with the exception of names of scientific journals. The term is not part of any current diagnosis manuals. The classical description of the alcoholic was done by Jellinek indicating someone who is unable to drink normally. This description was based on interviews and experiences with patients visiting clinical settings and in self-help groups such as Alcoholics Anonymous. The term alcoholism is connected to the view of the phenomenon as a chronic disease that is progressive and often fatal, with denial as a central feature. Views that have been disproved by epidemiological and psychological research. Successful outcome in recovery have even been related to pre-treatment denial and the nonacceptance of the label alcoholic (Orford 1973). Many heavy drinkers who do not wish to be called alcoholics even if they have experienced negative consequences, while others see it as an important part of acknowledging their problems and emphasize the need for them to stay abstinent (Wallhed Finn et al. 2014).

1.10.3 Alcohol addiction

According to the American Society of Addiction Medicine, addiction is defined as a chronic medical disease involving processes in the brain, genetics, the environment and life experiences. People with addiction drink alcohol compulsively and often continue despite harmful consequences. According to Koob, alcohol addiction is a chronically relapsing disorder characterized by compulsion to drink alcohol, loss of control over the drinking and a negative

emotional state (Koob 2014). In the research literature the term addiction is often used in papers about neuroscience, about theoretical explanations for the disorders or about behavioural addictions where no substances are involved. Addiction can be used to describe the psychological or compulsory aspects of substance use disorders while dependence is used to describe physiological aspects of tolerance and withdrawal. Like the term abuse, addiction have been viewed by some as pejorative and stigmatizing (O'Brien 2011). In Swedish the same word 'beroende' is used for both addiction and dependence.

1.10.4 Heavy use over time

The classifications of alcohol use disorders in the diagnostic manuals have been criticized. There are examples of individuals that fulfil the diagnostic criteria for dependence, but do not drink excessively. Social norms about drinking also affect what is seen as problematic and can give very different estimates for prevalence of alcohol dependence in countries with similar total alcohol consumption. One proposed alternative is to abandon diagnostic criteria in favour of a measure of regular high alcohol consumption - "heavy use over time" (Rehm et al. 2013). The argument is that it is heavy alcohol use that causes the harms from alcohol. Heather has objected that this definition is not sufficient because the patients do not usually regard the heavy use over time as the main problem but the addiction, i.e. the inability to refrain from heavy use (Heather 2013). Many researchers have argued that a continuous concept of alcohol use disorder is required (Glass et al. 2017). One way to improve would be to include the level of alcohol use as part of the alcohol use disorder diagnostic criteria (Rehm et al. 2019).

In the studies in this thesis the diagnostic criteria for both alcohol dependence and alcohol use disorder have been used in combination with continuous measures of alcohol consumption and the AUDIT instrument. The focus is on alcohol use disorder as defined in the DSM-5 which includes individuals with harmful alcohol use and alcohol dependence (ICD). In the first study a wider population of hazardous users was targeted.

2 Theories of alcohol use disorders

Alcohol use disorders are not the result of any individual weakness or moral failing, but according to different theories arise from a complex interaction of individual psychological, biological, social, and cultural factors. This section will give a brief overview of some theories on how alcohol use disorders are developed, maintained and changed.

2.1 Biological factors

2.1.1 Genetic risk

How a person is affected by drinking alcohol and experiences rewards or negative effects seems to be affected by genes. For example, a mutation in the gene ALDH2 causes impaired metabolism of alcohol, leading to blushing and nausea (Li et al. 2012). Family studies have shown that the risk of alcohol use disorders can be linked to both genetic inheritance and a shared environment. A Swedish study on adoptees conducted during the 1980s showed that there were two types of alcohol dependence among men. Type 2 had early onset, impulsive and sensation seeking traits, often social problems and high heredity (about 90%). Type 1 had a late onset, slower dependency development and few social problems. People in this group had low heredity (about 40%) (Cloninger 1981). Twin and adoption studies have showed that about 50% of alcohol use disorders are heritable (Verhulst et al. 2015). Genetic factors play a major role, but environmental risk factors and interactions between genes and the environment also contribute to the development of alcohol use disorders (Carvalho et al. 2019). DNA studies have failed to find any specific gene that leads to alcohol use disorder. Rather, a variety of genes appear to be protective or risk factors that may affect whether or when someone develops alcohol use disorder (Clarke et al. 2017). The picture is complicated by epigenetic processes which mean that the influence of genes can be influenced by environmental factors and by the effects of alcohol (Pucci et al. 2019).

2.1.2 Alcohol in the brain

Neurotransmitters constantly transmit signals between neurons in the brain. They are secreted from the axon of the neuron and attach to receptors on the dendritic of nearby neurons. This process triggers electrical activity in the neuron which in turn sends signals that rapidly spread in various complex systems in the brain. Alcohol gets its effects through how it affects these signalling systems. Alcohol easily travels through the blood-brain barrier and into the brain. The effect comes within minutes after it is ingested (Spanagel 2009). There are different types of neurotransmitters, neurons and receptors that have different functions in the brain. Both the signalling substances and the areas of the brain involved help explain the effect of drugs like alcohol. Several neurochemical systems are affected by alcohol consumption. The glutamate and γ-aminobutyric acid (GABA) systems act as accelerator (excitatory) and brake (inhibitory) in the brain and are linked to the calming and anxiety reducing effects of alcohol. The opioid peptide system is linked to pleasure, well-being and pain relief. The dopamine system is central to habit learning and motivation when it comes to things that are

important to our survival. The cannabinoid system affect appetite, pain sensation, mood and memory. The serotonin system plays an important role in mood and cognition (Koob 2014; Spanagel 2009). There is still a great deal of uncertainty as to how exactly alcohol affects the brain's system. There is extensive individual variation in the effects of alcohol depending on for example age and sex (Carvalho et al. 2019).

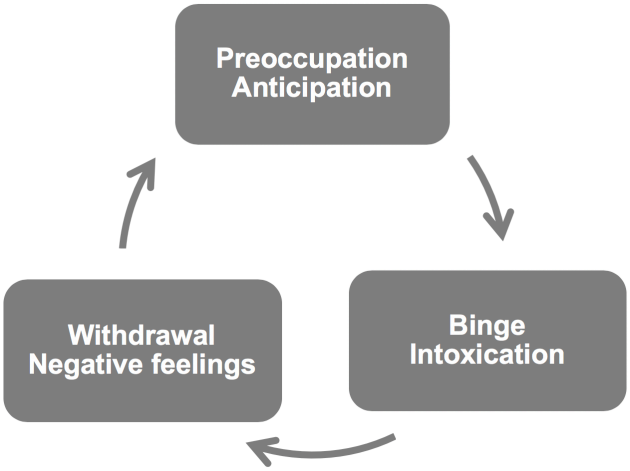
2.1.3 The reward system

Our brains have a system of neurons that use dopamine to keep up the behaviour required to approach and obtain natural rewards, the mesolimbic dopamine system, also called the reward system. The system is in an old part of the brain, from an evolutionary perspective, which is common to all vertebrates. The purpose of the reward system is to reinforce behaviours that are important for survival such as eating, drinking or having sex. The reward system was discovered by mistake during experiments on rats that were given electrical impulses in central parts of the brain and began to repeat the behaviours associated with the impulse. Alcohol affects the activity of the reward system. Increased dopamine content in the reward system creates a sense of euphoria and reward that makes us want to repeat behaviours that are linked to the positive experience. Recent research indicates that dopamine is primarily involved when we experience new or unexpected rewards and ensures that we learn and are motivated to continue to seek these rewards. Other systems are also involved in the reward process by indirectly leading to increased dopamine levels or by providing positive experiences such as enjoyment (opioids), connection (serotonin) or relaxation (GABA). Brain areas involved in the reward system are the extended amygdala, the nucleus accumbens, the orbitofrontal cortex and the dorsal striatum, which are areas responsible for reinforcement, decision making, and impulse control (Spanagel 2009).

2.1.4 Development of addiction

Drugs can give rise to higher levels of dopamine than many natural rewards. Alcohol can double the dopamine level, which is equivalent to having sex. To seek such rewards may be perceived as equally or more important as activities needed for our survival. This phenomenon has been likened to the reward system being kidnapped by the effects of alcohol. Others have described the relationship with alcohol as a sort of love. The development of addiction coincides with successive changes in the brain's receptor system that control reward, memory and impulse control. The development can be described as a circular process with three main stages. As an individual moves from impulsivity to compulsivity, a shift occurs from positive reinforcement that drives the motivated behaviour to negative reinforcement that drives the behaviour The following describes the neurochemical processes that contribute to the development of alcohol use disorder (Koob, 2004) (see figure 1).

Figure 1. Addiction cycle



Binge consumption / intoxication: Regular binge consumption of alcohol is reinforced by the positive effects in the brain reward system described above. The initially strong dopamine activation can lead to alcohol seeking behaviour where the person repeats behaviours that have previously led to the reward, without much intention.
Preoccupation / anticipation: Cues in the situations in which alcohol have been consumed are linked to the effects of the alcohol in the brains reward system by imprinting (in the amygdala and hippocampus) and by classical condition (e.g. in dorsal stratium). This leads to cravings and forming of habits of continued regular drinking. When the alcohol use disorder becomes more severe, alcohol-seeking behaviour can become so strong that it is perceived as compulsive or automatic. Brain imaging has shown how areas of the brain connected to craving and desire are activated when people are exposed to things that are associated with previous drug use. Even small amounts of alcohol can trigger the desire. Heavy alcohol use over time is also associated with impaired function in the frontal lobe, which can lead to impaired impulse control and ability to make decisions.
Withdrawal / negative feelings: As tolerance develops for the effects of alcohol, the brain becomes less receptive, increased doses are required for the same effect. The brain strives to maintain balance within and between different functions. When a person regularly drinks heavily it will make the systems less sensitive to the effects of alcohol (i.e. neuro adaption) by reduced release of signal substance, reduced number of receptors, more purifying enzyme or activation of the hypothalamic–pituitary–adrenal axis and brain stress neurotransmitter systems. The down regulation can make the person feel low or depressed and create a desire to use alcohol to feel more normal (e.g. negative reinforcement). Prolonged alcohol intake can result in impaired ability for the brain to regain its original function and some symptoms may only disappear after a long period of abstinence.

Severe alcohol use disorder can be described as a disease of the brain that goes from impulsivity to obsession and compulsivity. The development involves gradually increasing experiences of loss of control, desire and negative feelings. Genetic and environmental factors make it different for different people (Spanagel 2009). There seem to be a consensus among researchers that alcohol use disorder is a disorder in the sense that it is not a moral failing, lack of character or a certain addicted personality. And that people suffering from alcohol use disorders should be offered treatment or care. But there is no consensus regarding its status as chronic brain disease. Lewis have argued that psychological change, development and,

indeed, all learning involve brain change and that the neuroscientific research so far, have been unable to demonstrate that changes caused by substance use are fundamentally different from how other intense learning or experiences change the brain (Lewis 2018). Several researchers have pointed out problems and limitations with the brain disease model of addiction. And that it is not supported by animal and neuroimaging evidence to the extent its advocates suggest (Heather et al. 2018). The acute and reinforcing aspects of addictive drugs like alcohol are usually not disputed, but what seems yet to be determined is if the drugs themselves have effects on the brain that even in the long run make them more addictive than other behaviours (i.e. gambling or gaming) that seem equally addictive. One common element of behaviours that are exemplified by Lewis as equally addictive, is that they tap into brain processes that are linked to survival (food, sex and not being socially excluded) (Lewis 2018).

2.2 Psychological factors

2.2.1 Classical conditioning

Repeated alcohol consumption can be understood by the principles of classical (Pavlovian or respondent) conditioning. Classical conditioning occurs when a previously neutral stimulus is coupled with an existing reflex so that the stimulus can elicit the response. The classic example of this is Pavlov's dog experiment. There was a sound every time before the dogs' food was produced. After repetition, the dogs began to drool as the sound was heard, although no food was produced. A so-called unconditional reflex such as dogs' saliva production depends on biological evolution. The conditional response, on the other hand, depends on the individual's experience. The positive experiences in the brain created by alcohol as well as the craving developed after repeated use can be regarded as unconditional reflexes. When alcohol consumption is repeated in situations where specific stimuli are present, a conditional response is created. A conditional response (desire or drug seeking behaviour) occurs regardless of whether the conditioned stimuli (e.g. cue) lead to alcohol use or to positive experiences at a particular occasion or not. Cues can be external phenomena such as place, time and company or internal like thoughts and feelings. It is not the behaviour of drinking alcohol but the internal responses to alcohol itself that are linked to the cue in classical conditioning (Onken et al. 1993).

2.2.2 Operant conditioning

The concept of operant condition was developed by psychologist B.F. Skinner and means that behaviours are reinforced or extinguished depending on the consequences of the behaviour. When alcohol consumption is linked to repeated experiences of rewarding consequences, the likelihood of continued alcohol use increases. The reinforcement is made stronger when:

- The reinforcing consequences come directly in connection with the behaviour.
  The value of the reinforcing consequence is discounted over time.
- The reinforcing consequences are perceived as major or as important.

- The behaviour always or often leads to the reinforcing consequences.
- The link between the behaviour and the reinforcing consequences is clear to the individual.

Reinforcement means that the consequences of a behaviour increase the likelihood that the behaviour is repeated. In this context, it is the positive effects of alcohol use, which leads to an increased likelihood that alcohol is consumed in higher quantities or more frequently. *Positive reinforcement* is when the consequence of a behaviour is that something appreciated or desired arises or increases, e.g. to feel happy or relaxed after a beer. *Negative reinforcement* is when the consequence of the behaviour is that something that is undesirable decreases or disappears, e.g. pain or anxiety are relieved after having a couple of drinks (Baldwin and Baldwin 2001).

In the short term, alcohol consumption is reinforced for most people. Those who experience punitive consequences right away when they drink alcohol (for example due to hereditary factors) usually do not continue with high alcohol consumption. But when a person consumes a lot, there is usually negative consequences (such as loss of control or negative emotions). In the long run, the consequences of heavy alcohol consumption are usually negative, but more difficult to link to alcohol use. When people start using alcohol it is mostly positively reinforced, whereas when the person has developed an alcohol use disorder, it becomes more negatively reinforced. According to operant psychology, behaviour that stop having reinforcing consequences will eventually cease (extinction). Although positive reinforcements of alcohol use diminish after a while, extinction of the drinking is prevented by it instead becoming negatively reinforced. Both the actual effects of the alcohol and effects associated with other behaviours or events that coincide with the drinking (e.g. celebration or enjoyable socializing) can reinforce alcohol use (Meyers and Smith 1995; Baldwin and Baldwin 2001).

The likelihood of alcohol use is higher in situations similar to those where use has previously led to good consequences. The behaviour is linked to specific cues (so-called discriminative stimulus) that signal that it will lead to positive consequences if performed. For example, "after work with friends" may be a stimulus for alcohol consumption while "in the car with the children" is not. The conditioned appetitive motivational model proposes that the positive incentive value of alcohol plays a predominant role in alcohol use and that compulsive drinking is maintained by appetitive motivational processes rather than by negative reinforcement. Alcohol seeking behaviour often occurs in the absence of withdrawal distress or other aversive states, and tolerance is believed to develop to aversive effects but not to positive effects of drugs (Rohsenow et al. 1990). Incentive models are better supported by the research literature than withdrawal models (Carter and Tiffany 1999)

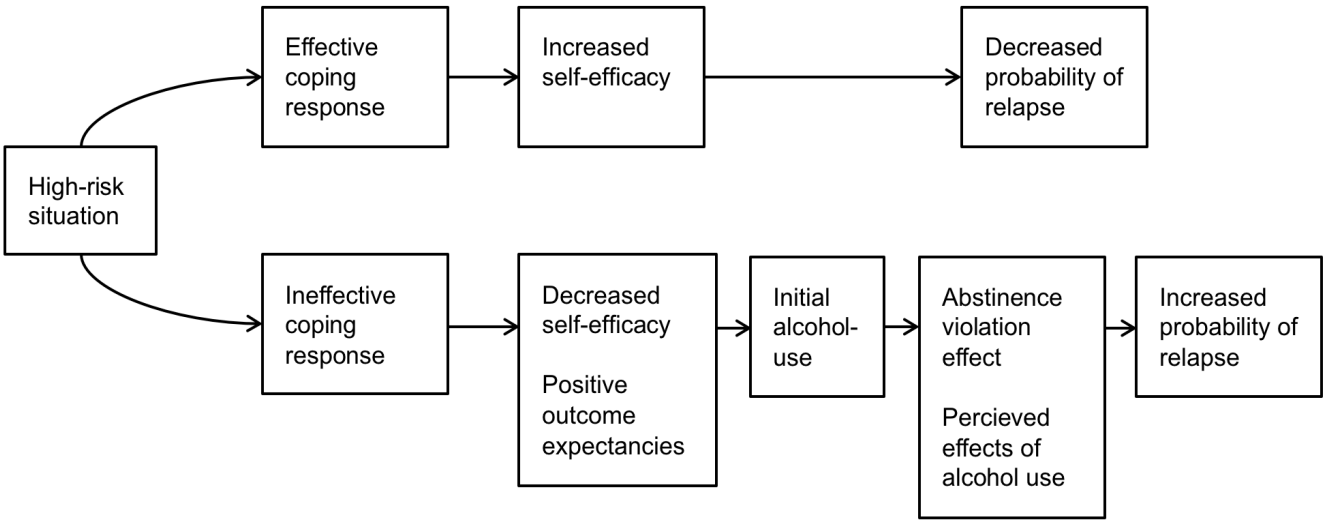
2.2.3 Social learning theory

Learning behaviours are also largely associated with our ability to cognitively manipulate and store symbolic representations of our environment. In other words, what and how we think about alcohol use affects the way we drink; but how we use alcohol also affects how we think about it, and so on (referred to as reciprocal determinism). Learning can occur through many different channels. Most powerful by direct experience, where efforts with partial success will feed back and change expectations of outcome and efficacy. But also, by observing others engaging in a behaviour or through verbal information. For someone with alcohol use disorder, watching someone drink will influence outcome expectations (e.g. "having a drink will lead to a pleasurable experience") and expectations regarding self-efficacy ("I will not be able to refuse the offer of a drink"), which then increases the probability that drinking occurs. Social learning theory, developed by Bandura, introduce these cognitive processes in learning behaviours like drinking alcohol (Bandura 1977). Cognitive factors like anticipation, planning, expectancies and self-efficacy all play a part in a learning process that gradually can lead to alcohol use disorder (Niaura 2000). Self-efficacy is the belief that one has the ability to implement the behaviours needed to produce a desired effect. In several studies of substance use, self-efficacy has emerged as an important predictor or mediator of treatment outcome (Kadden and Litt 2011).

2.2.4 Relapse prevention

A model based on social learning theory, the relapse prevention model (Marlatt and Gordon 1985), assumes that individuals suffering from alcohol use disorders have inadequate skills that increase the likelihood of relapse, i.e. resumed use of alcohol (see figure 2). Skills can be indirectly linked to alcohol use, such as coping with negative emotions or dealing with social situations without using drugs. They can also be directly linked to the alcohol use as skills in refusing drinks, managing craving or limiting the amount of alcohol consumed. According to Marlatt, a conditioned stimulus starts cognitive processes of two distinct types; anticipated positive effects of drug use coupled with desire (called the craving response), and the intention to use the drug (called urge). Relapse prevention describe the process when attempts to control addictive behaviours fail as a transition from a single 'lapse' to 'relapse' into previous drinking behaviour. One phenomenon described in relapse prevention, *called seemingly irrelevant decisions*, are when an individual make a number of decisions about what to do or where to be who are not directly linked to alcohol use, but bring the person closer and closer to a situation where alcohol is more difficult to avoid. Another phenomenon described is the *abstinence violation effect*, is that once a person has entered a bar or had a glass, they may as well continue to drink because they have already violated their sobriety.

Figure 2. Relapse prevention model



2.2.5 Cognitive model

According to Becks cognitive model of alcohol use disorder, certain individuals have developed a cognitive vulnerability to alcohol (Beck et al. 1993). Under particular circumstances, specific core beliefs, or core schemas gives rise to anticipatory beliefs related to alcohol use, such as "I cannot socialize without drinking" that are activated in certain provocative situations, which in turn give rise to cravings. Cravings then activate permissive beliefs to indulge in alcohol use, which subsequently leads to drinking. People with alcohol use disorder sometimes describe recurring automatic thoughts on alcohol in specific situations, that make it more difficult to avoid drinking. They are also more aware of stimuli associated with alcohol than other things (called attentional bias). Thoughts are guided in a certain direction by this bias and can explain why a person does not consider alternative possibilities. A defining feature of cognitive therapy is the proposition that symptoms and dysfunctional behaviours often are cognitively mediated and that improvement can be produced by modifying such dysfunctional thinking and beliefs (Beck et al. 1993; Wright et al. 1993).

2.2.6 Self-determination theory

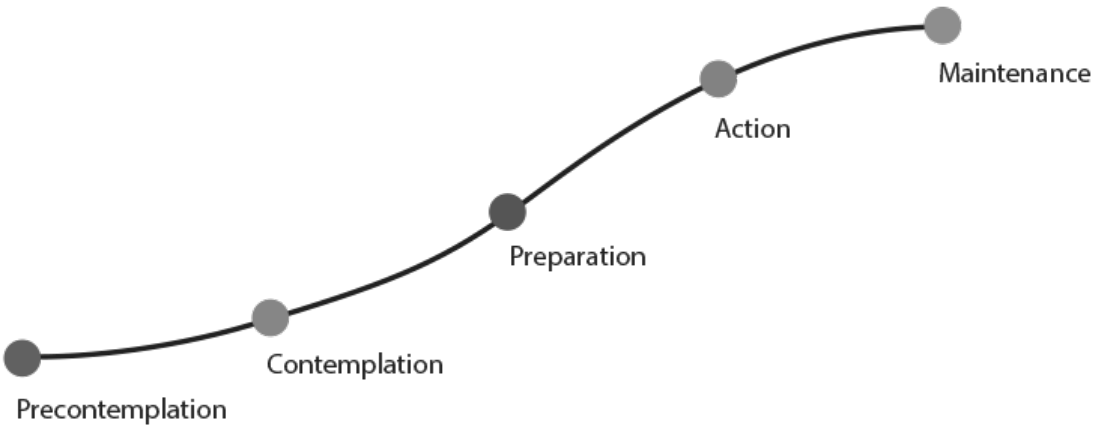
According to self-determination theory people have fundamental psychological needs for autonomy, relatedness, and competence. An activity is placed on a continuum, from completely initiated and controlled by external factors, to fully self-determined determine the motivation for engaging in them. When social activities are perceived as controlled or coerced, the individual's intrinsic motivation (i.e., interest and engagement) in the activity is undermined. This prediction has been supported in a variety of health behaviours often accompanied by social pressure (e.g. smoking and weight) (Deci and Ryan 2004). In a study of alcohol treatment, clients high in both internalized and external motivation demonstrated

the best attendance and treatment retention while those low in internalized motivation showed the poorest treatment response, regardless of the level of external motivation (Ryan et al. 1995).

2.2.7 Stages of change

According to the Transtheoretical Model of Change individuals will move through a series of stages (see figure 3) in order to achieve lasting behaviour change. Being undecisive or ambivalent as well as relapsing are regarded normal parts of the process (Prochaska and DiClemente 1986). Despite some criticism regarding the empirical foundation of the specific stages of the model, it is often used as a pedagogical model for better understanding the process of change from alcohol use disorders. When measured readiness to change has predicted changes in alcohol use after treatment in a number of studies (Gaume et al. 2017; Bertholet et al. 2009).

Figure 3. Stages of change



Pre-contemplation is the period before the individual recognizes the need to make a change. **Contemplation** is when a person recognizes a problem and considers doing something about it. **Preparation** may include a decision and a plan for changing their behaviour. **Action** stage in which the individual attempts to change the behaviour. **Maintenance** comes when the behaviour has been successfully changed. **Relapse** is when the person fails to maintain the change.

2.2.8 Self-medication

According to Khantzian's self-medication theory, alcohol and other substance use is a compensatory means to modulate affects and soothe oneself in response to strong negative emotions. The theory states that alcohol become addicting because it has the power to alleviate, remove, or change psychological suffering in the individual. The individual's choice of drug is in part related the specific psychological and physiological effects. The self-medication hypothesis primarily comes from clinical observations of patients with substance use disorders (Khantzian 1985). Depression, anxiety and other psychiatric disorders are overrepresented among individuals with excessive alcohol use and co-occurring psychiatric disorders are

associated with a worse outcome in treatment of alcohol use disorder. But most individuals with alcohol use disorder do not report any symptoms of psychiatric disorders (Grant et al. 2015) and may not recognize themselves in the description of self-medicating.

2.2.9 Ego depletion or fatigue

Life is filled with behavioural impulses to do things that might run counter to our conscious intentions. This might be especially true for people with alcohol use disorders. Inability to control impulses can lead to severe consequences such as relapse in alcohol use disorder. But our self-control resources are limited, and continued efforts in controlling a large number of impulses to drink can lead to a phenomenon called *ego depletion* or *ego fatigue* (Ostafin et al. 2008). In an experimental study, ego depletion induced by manipulation increased drinking, relative to control. And the effect of ego depletion on alcohol consumption was mediated by self-reported effort in suppressing emotion and thoughts during the manipulation (Christiansen et al. 2012).

2.3 Social factors

2.3.1 Learning from family or friends

The behaviour of using alcohol is usually passed on from more experienced users to beginners. Those who drink for the first time rarely do it alone. Rather, drinking begins with family members, partners or friends. According to sociological learning theories, a person needs to learn different steps to continue using a drug. It can be about learning the motives for taking the drug, the technique of getting intoxicated, recognizing the intoxication (which is sometimes weak at first) and connecting it to the drug, and learning how to appreciate the effects (which initially can be perceived as unpleasant). Experienced effects are important for a person to continue using drugs regularly but also group pressure and group norms. The norms and habits of the family when it comes to the use of alcohol is important. Early onset in alcohol consumption is a risk factor for future problems. For example, parents who allowed their fifth-grade children to drink at home were more likely to have children who drank alcohol later (Jackson et al. 1999). Children of parents who drink have also been shown to be less likely to view drinking as harmful (Hawkins et al. 1997). But good relationships with parents are a protective factor that counteracts the risk of developing alcohol use disorder (Velleman and Templeton 2016). In the teens, friends become more and more important. Drinking alcohol can make it easier to get accepted among peers, or give a clearer social identity or affiliation. Using alcohol can be a way to grow up, get rid of, or revolt against the parents. Longitudinal studies have demonstrated the influence of social learning on positive expectancies. Knowledge about alcohol, perceptions about friend's alcohol use and their attitudes toward alcohol use predicted alcohol-related expectancies (e.g. "If kids drink alcohol, it proves they are tough") Positive expectancies concerning the social benefits of drinking (e.g.

"Kids who drink have more friends") affected the relationship of these variables on subsequent alcohol use (Epstein et al. 2008).

2.3.2 Social norms

In Sweden, alcohol consumption is common and a part of many social contexts where there may be a perceived expectation that everyone should drink alcohol. Abstaining from alcohol in these contexts can be complicated and seen as deviant. In media, TV series, advertising and in social media, alcohol consumption is often reflected as something connected to celebrations and good quality of life. Expectations on alcohol being an important part of social interaction and adult life is sometimes called the *alcohol norm*. The perception of the norms to drink alcohol has been particularly studied among students (McAlaney and McMahon 2007). Social norms theory describes situations in which individuals incorrectly perceive the attitudes or behaviours of peers and other community members to be different from their own even if in fact they are not (Berkowitz 2005). This phenomenon that has been called "*pluralistic ignorance*". Most drinkers overestimate the alcohol use of their peers. As a result, those who usually are more moderate drink more than they would otherwise, and may also encourage others drink more. Heavy drinkers might be even more likely to believe in this misperception, which justify their own heavy drinking. This is called "*false consensus*", i.e. falsely believing that others behave similar to you, when they are not. False consensus and pluralistic ignorance are mutually reinforcing and self-perpetuating. In other words, the majority is silent because it thinks it is a minority, and the minority is vocal because it believes that it represents the majority. Providing accurate normative feedback is one way to break this cycle (Moreira et al. 2009).

2.3.3 The total consumption model

The total consumption model states that the total alcohol consumption in a society is positively related to the level of alcohol-related problems that society. In other words; the higher average alcohol consumption in a society, the greater will the number of individuals that experience harm caused by alcohol use be. One consequence of the model is that in preventing harm from alcohol use, measures that reduce the total consumption in a society (e.g. policies affecting price and availability of alcohol) are particularly important (Babor et al. 2010). The model has had a major impact in the Nordic countries and is the basis for Swedish alcohol policy. A positive association between population drinking and alcohol-related harm has been demonstrated in numerous studies of different countries and time periods (Norström and Ramstedt 2005). A recent Swedish study also found positive and statistically significant associations between population drinking and several harm indicators (Norström and Ramstedt 2018).

2.3.4 The prevention paradox

The prevention paradox is an epidemiological theory originally applied in reducing high blood pressure with public health measures (Rose 1981). The theory refers to the fact that a

large number of people at small risk (e.g. hazardous alcohol use) can give rise to more total harm and higher costs to society than a small number of people at high risk (e.g. severe alcohol use disorder). According to the prevention paradox it is more effective to produce small changes in the entire population than to focus on the smaller group with severe disorders. One key question regarding the prevention paradox is where the division should be made between risk-groups. The majority of acute social problems are found among consumers who drink moderately in terms of annual intake, but the majority of such problems also occur in a high-risk group defined in terms of amount per drinking occasion. This means that most of the binge drinking is found among consumers with a moderate annual consumption level, which has been called the 'second-order prevention paradox' (Skog 2006). This observation has been confirmed in several studies (Rossow and Romelsjö 2006)

2.3.5 Central activity

Another social explanation for alcohol use disorder is that drinking can become a *central activity*. It is the result of a series of everyday decisions that are made over a long period of time. People usually live their lives in different social worlds and those worlds we spend a lot of time in, we form a belonging to. Heavy drinking can lead to marginalization and difficulties but also offer the individual relief and enjoyment. For some individuals, whose lives have, started to revolve around heavy alcohol use, drinking may be said to have become a central activity. Ceasing a central activity usually has major consequences for the individual. Competencies from the drinking world might not have any value outside of it. Stigma and financial problems can remain even if the person stop drinking. These things make choices more limited for the individual and can maintain alcohol use disorders (Fingarette 1988).

2.3.6 Socio-cultural perspective

References to heavy drinking habits as an individual disorder were rare in pre-industrial Europe, despite the fact that per-capita consumption was considerably higher than today. According to a social-historical constructionist perspective, notions such as "alcoholism" and "dependence" are depending on socio-cultural characteristics that are specific to particular times and places. When alcohol is present in a society, some people will probably drink in a way that violates established norms or causes harm. The social consequences of such deviant drinking, as well as the ways in which it is interpreted will, however, depend on social factors, specific to the particular time and place. These interpretations and explanations will in turn guide the way in which society responds to deviant alcohol use, but will also be transformed into cultural stereotypes, that deviant drinkers might apply to themselves to explain their own behaviour and to interpret their own feelings (Blomqvist 2002).

2.4 PRIME-theory

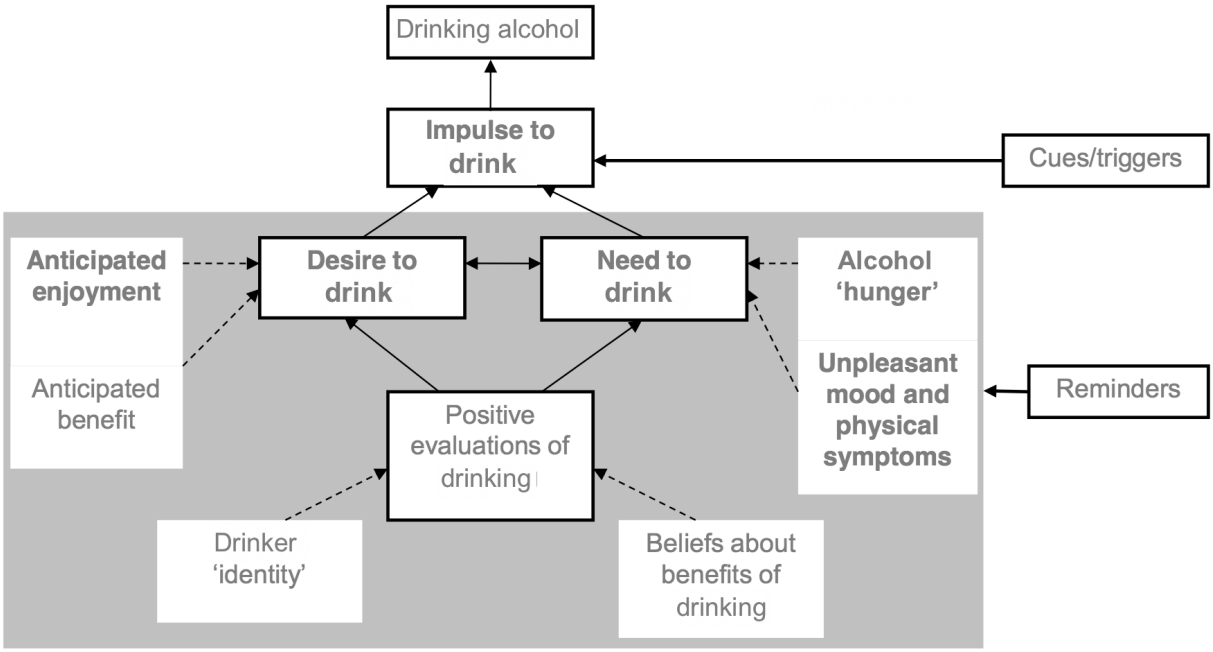
The *PRIME theory* is a synthetic theory of motivation that offer a framework for understanding the heterogeneity of alcohol use disorders and other addictions. It integrates five levels of motivation: plans, responses, impulses and inhibitory forces (sometimes felt as urges),

motives (sometimes experienced as feelings of want or need) and evaluations (evaluative beliefs). Human motivation can, according to PRIME, be described as a system of interacting forces resulting from internal and external stimuli operating on innate and learned dispositions. This motivational system is unstable and requires constant balancing input to remain adaptive. According to the theory addiction arises out of a failure of balancing input (see figure 4) that lead the system into maladaptive paths in which unhealthy priority is given to behaviours like drinking alcohol. The motivational system, as described in PRIME, does not determine the behaviour in a cause-effect manner, but rather balance it (West 2006). The theory argues that alcohol addiction arises out of three types of abnormality:

- in the motivational system that are independent of the drinking behaviour (e.g. propensity to anxiety, depression or impulsiveness)
- in the motivational system caused by the drinking behaviour (e.g. habits, withdrawal symptoms and acquired drives)
- in the physical and social environment that contributes to the drinking having an abnormally high priority.

Interventions should, according to PRIME, create a feeling of desire or need to change that lead to an impulse to initiate a change. It should also create a lasting commitment to the change based on a shift of identity, with activities that can sustain the plan (West 2006).

Figure 4. Example of PRIME-theory with alcohol use



2.5 Two perspectives on alcohol problems

For many years two different paradigms, the medical perspective and the public health perspective, have existed in the alcohol research field (Edwards et al. 1977) that both are relevant for this thesis.

The medical perspective on alcohol use primary focus is on studying people in clinical alcohol treatment and on investigating individual with severe alcohol use disorder. Alcohol use problems are usually dichotomized into mostly non-problematic use or alcohol addiction. What starts as an intended and controlled use, turns into a compulsion to use alcohol among individuals with a genetic predisposition. Alcohol addiction is seen as a chronically relapsing brain disorder, which include changes in the structure and function of the brain, following repetitive heavy alcohol use (as described in 2.1.4 above). The medical perspective on alcohol use disorders is closely connected with neurobiological research and also partly with the AA tradition.

The public health perspective primarily focus is the general population. It emphasizes that alcohol use problems are found not only among heavy drinkers in clinics, but in various degrees among the entire drinking population. From a public health perspective, alcohol use problems are best viewed on a spectrum from hazardous use to alcohol dependence. Less severe drinking is still considered potentially problematic for both the individual user and the society in whole. Survey research (e.g. WHOs reports on global alcohol consumption), the *total consumption model* and *the prevention paradox* are central to the public health perspective on alcohol use problems. The public health perspective point to the fact that, according to survey data, the majority of people who meet criteria for alcohol use disorders resolve their problems, do it by abstinence or by moderation, do not seek or necessarily need treatment, and do not relapse repeatedly.

From a public health perspective, the medical perspective creates an arbitrary dichotomy between disordered and non-disordered alcohol consumption, which may be damaging, if it leads to less use of effective community and policy interventions. Also, a medical perspective runs the risk of overemphasising medical solutions and even risk creating a 'self-fulfilling prophecy' among patients, when they are told that they have a chronic disorder from which they cannot be cured. From a medical perspective, the public health perspective risk ignoring important experiences of some of those with the most severe problems (heavy use, compulsion and driven by negative affect) by including too many drinkers that are less problematic, in diagnoses etc. It also ignores the brain research implicating brain dysfunctions in the development of alcohol use disorder. Today most researchers and interested practitioners recognize the value of both perspectives, but might put more emphasis on one of them depending on their main focus.

2.6 Theories in internet interventions

Internet interventions for alcohol use have had a stronger connection to a public health perspective, with use in community and prevention settings, while internet interventions for other psychiatric disorders have been closer to a medical perspective. The most frequently used theories and models in the internet alcohol intervention research are theories connected to Motivational Interviewing, Transtheoretical Model and Social Norms Theory, according

to a recent review (Kaner et al. 2017). More extended internet programs like those used in this thesis are usually based on psychological theories connected to Cognitive Behavioural Therapy like classical and operant conditioning and social learning. In recent years brain researchers have recognized internet interventions as a promising area that can incorporate knowledge about brain processes and integrate new methods into the treatment of alcohol use disorders (Carvalho et al. 2019).

3 Responses to problematic alcohol use

Alcohol consumption and alcohol use disorder are important to address in health care because of the health consequences, but it is also a wider problem involving many parts of society. Some effective interventions for reducing alcohol use are found in health care and others in the society. The focus of this thesis is internet interventions, but first an overview of other types of interventions for alcohol is given.

3.1 Alcohol policy

Alcohol policy are efforts on the part of governments, authorities or other organisations working on a society level, to prevent or reduce negative consequences of alcohol consumption. Such policy strategies usually fall into one of seven areas (Babor 2010):

- Pricing (e.g. customs and taxation)
- Regulating availability of alcohol (e.g. monopoly, licensing and opening-hours)
- Modifying the drinking context (e.g. training bar staff in responsible beverage service)
- Counteract drink-driving (e.g. driving-license suspension or revocation)
- Restrict marketing
- Education and information (e.g. school prevention programs, warning labels on alcohol containers)
- Early intervention and treatment (e.g. brief intervention in primary-care)

Alcohol policy measures that are directed towards all drinkers in the population can be used to regulate per capita consumption effectively on a society level. Control of prices and restriction of availability of alcohol are two of the most effective such measures. The per capita alcohol consumption is a strong determinant of the alcohol-related harm in a population. Despite the burden caused by alcohol mentioned above and despite effective policy strategies being available, alcohol has historically been a low priority in public health policy and prevention efforts, compared to communicable and non-communicable diseases (Babor et al. 2010). During the 20th century Sweden pursued strict alcohol policies with restrictions on price, availability and advertising (Bruun 1975). During the first half of the century Sweden employed a rationing system and there is still a state-owned monopoly on retail sales of alcohol. Since Sweden joined the European Union in 1995, the strict policies have gradually been loosened.

3.2 Spontaneous remission

Previous research has shown that the vast majority of individuals who resolved their problematic alcohol use have done so without any professional help (Sobell et al. 1996). In cohort studies in general populations, the recovery rates from alcohol use disorders are high. In a prospective cohort study in the Netherlands, 70 % who fulfilled DSM-5 criteria for alcohol

use disorder at baseline, had recovered at follow up three-years later (Tuithof et al. 2013). Among individuals with alcohol use disorder according to DSM-5 prior to past year 34.2% were classified with persistent alcohol use disorder, 30.3% were high-risk drinkers, 19.5% low-risk drinkers and 16.0% abstainers, in recent data from a large representative sample from the United States. According to Blomqvist (1996) there is no single unambiguous rate of spontaneous recovery or remission because the estimates depend on the diagnostic criteria adopted and on the definition of "remission" and "treatment". Becoming aware of one's own problematic use is often the first step toward changing and does not necessarily coincide with having hazardous alcohol use or being diagnosed with an alcohol use disorder. When individuals who have recovered have been asked about their experience they often describe self-control and willpower, support from significant others, and perceived improvements in health and social life as important in recovering. A change is often preceded by experiences of despair or crisis. The momentum of change lies not so much in various critical events per se as in how these events are interpreted and reacted to (Blomqvist 1996). A series of negative events (often of trivial or mundane character) can lead to the decisional balance tipping to the side of quitting (Sobell et al. 1993).

3.3 Self-help groups

People meet in groups to help and support each other to abstain from alcohol by sharing their personal experiences of dealing with problematic alcohol use. The groups meet regularly and often anonymously and can be closed to members or open for anyone who want to participate. Alcoholic Anonymous (AA) is the most well-known self-help group which started in the United States during the 1930's. AA consists of several million members in 181 countries. In North America, it is the most commonly sought source of help for alcohol use disorder. AA meetings typically last 60 to 90 minutes, during which group members share personal narratives of their alcohol addiction and recovery experiences, and help one another practice the principles in the 12-step program. AA has a spiritual component, but many members do not consider the spiritual aspects of the program central (Kelly et al. 2020). AA considers total abstinence the primary goal of recovery. AA also believes alcoholism to be a chronically relapsing disorder, and therefore encourages participants to keep coming to meetings indefinitely (Miller and Kurtz 1994). There are several other self-help groups available (e.g. Moderation Management, SMART-recovery, Life Ring and Swedish the Links) but these are less widespread.

3.4 Bibliotherapy

Bibliotherapy is a self-help intervention that is presented in a written format, designed to be read and implemented by the person who is drinking excessively. There is a variety of formats from brochures with a few pages to self-help manuals and books with several hundred pages. In a meta-analytic review of 22 studies, between-group comparisons of bibliotherapy with no-intervention controls showed a small to medium effect, with a weighted mean effect size of 0.31. Between-group comparisons of effects on drinking of bibliotherapy versus more

extensive interventions showed effect sizes near zero (Apodaca and Miller 2003). Effect size refers to a standardized measure of the effect, like *d* (Cohen 1988) or *g* (Hedges 1981). See table 3 for magnitudes.

Table 3. Magnitude of effect sizes

Effect size	**d or g**
Small	0.20
Medium	0.50
Large	0.80

3.5 Brief interventions

The first step of grasping the issue of alcohol use disorders is, from both a public health and medical perspective, to identify individuals with or at risk of developing the disorders. Screening and Brief interventions (SBI) is an intervention aimed at reducing alcohol consumption among individuals by enhancing their readiness to change it. SBIs are aimed at patients who are not primarily treatment seekers for their alcohol consumption, where the health care staff raises the issue of alcohol. This is also known as opportunistic screening. SBI usually includes questions covering the patient's level of alcohol use. This is then followed by normative feedback on the patient´s alcohol use compared to others or in comparison with national guidelines, information on health risks associated with drinking, and/or advice on how to cut down. The WHO has pursued SBI in primary care (McCambridge and Cunningham 2014), starting with the development of the Alcohol Use Disorders Identification Test (AUDIT) questionnaire in the 1980's (Saunders 1993). Referral to Treatment has been added to the model, expanding it to Screening, Brief Interventions and Referral to Treatment (SBIRT). But a recent study showed that the intervention was associated with lower likelihood of receiving specialty addictions treatment (Frost et al. 2020). A recent meta-analysis including 34 randomised controlled trials (RCTs), showed that SBI reduce alcohol consumption by around 20 grams of alcohol per week compared to minimal interventions at twelve months follow up (Kaner et al. 2018). But there have been difficulties in implementing SBI in regular practices despite great efforts (McCambridge and Saitz 2017) and there is an absence of evidence for the effects on alcohol consumption for individuals with dependence or very heavy drinking (Saitz 2010). A Swedish study has showed that reduced alcohol consumption was more likely in SBIs that lasted a little longer and included advice on how to reduce consumption (Nilsen et al. 2011).

3.6 Motivational Interviewing

Motivational Interviewing (MI) is a form of brief intervention that can be combined with screening, delivered stand-alone or as a part of another intervention. MI is a client-centred method for enhancing intrinsic motivation to change by exploring and resolving ambivalence. MI integrates the relationship-building principles of Carl Rogers with more directive

strategies. MI is defined as a collaborative, goal-oriented style of communication with particular attention to the language of change. It is designed to strengthen personal motivation for and commitment to a specific goal by eliciting and exploring the person's own reasons for change within an atmosphere of acceptance and compassion (Miller and Rollnick 2012). There are explicit standards for practitioners regarding education and competence and there are methods for assessing treatment integrity (Moyers et al. 2005). A meta-analysis of MI as a brief intervention for excessive drinking included 22 studies and found a small effect size of 0.18, when compared with no treatment (Vasilaki et al. 2006). A longer variant of MI called Motivational Enhancement Therapy (MET) is manual-based and was developed as part of Project MATCH. In MET which usually consists of five sessions, MI is combined with feedback based on assessment questionnaires and laboratory tests (i.e. Drinker's Check Up) and also involve a concerned partner or family member (Miller 1995). MET has showed effects similar to Cognitive Behavioural Therapy (CBT) and Twelve step in treating alcohol use disorder (Allen et al. 1998).

3.7 Stepped care

Stepped care has been suggested as a cost-effective approach to treatment for alcohol use disorders (Sobell and Sobell 2000). Stepped care begins with a low intensity intervention, like SBI, and continues up to more intense interventions if not enough progress is made. How the patient's alcohol use develops during care, rather than his or her pre- treatment characteristics, guides the type and amount of interventions that are delivered. Wallhed Finn described a stepped care model from SBI to treatment of alcohol use disorder in her thesis (Wallhed Finn 2018). The next step after SBI is a Drinker's Check Up session, which has been found to in itself decrease alcohol consumption (Miller et al. 1988). After the check-up guided self-help, pharmacological or phycological treatment is added in a third step. In a RCT in Sweden the later steps of this model were tested in primary care compared to specialized treatment of alcohol use disorder, with non-significant differences between the groups found at six- and twelve-months follow-ups (Wallhed Finn et al. 2018)

3.8 Treatment of alcohol withdrawal and overdose

Abrupt termination of heavy long-term alcohol consumption may lead to withdrawal. Symptoms of withdrawal range from mild (e.g. rapid heartbeat, elevated blood pressure, excessive sweating, shaking or anxiety) to very severe (e.g. hallucinations, seizures or delirium tremens) which are life-threatening conditions. More severe symptoms require pharmacological treatment in order to reduce the risk of brain damage or death. Recommended treatment for alcohol withdrawal is benzodiazepines. Getting treatment of alcohol withdrawal can relieve acute discomfort, reduce withdrawal symptoms, and reduce the risk of epileptic seizures, delirium and relapse into renewed alcohol consumption. Alcohol withdrawal treatment may offer an opportunity to start long-term treatment for alcohol use disorder (Becker 2008). Alcohol can also be overdosed, which may have acute life-threatening consequences. Symptoms of alcohol overdose are nausea and vomiting, followed by inability to stand, absent

reflexes, difficulties in keeping awake, slow or irregular breathing and pale skin. Alcohol overdose is treated by monitoring oxygen saturation and vital signs and sometimes with intravenous hydration and/or respiratory support.

3.9 Pharmacological treatment

There are currently several available pharmacological treatments for the treatment of alcohol use disorder. *Disulfiram* inhibits the liver enzyme aldehyde dehydrogenase, leading intake of alcohol to causes unpleasant somatic reactions. Knowing this can help the patient avoid impulses to drink. A meta-analysis of 22 RCTs (N = 2414 participants), with primary outcomes related to abstinence from alcohol, disulfiram was associated with a higher success rate than control conditions only in open-label studies ($g = 0.70$). No significant association were found in blinded trials, which are methodologically difficult because no group can take the risk of drinking alcohol (Skinner et al. 2014). Pharmacological anti-craving treatments aim to reduce the rewarding effects of alcohol. *Naltrexone* is an opiate receptor antagonist, which previously has shown efficacy in reducing risk of heavy drinking and reducing alcohol consumption among individuals with alcohol dependence (Rösner et al. 2010). *Acamprosate* is a putative glutamate modulator, which has shown to reduce risk of drinking (Roesner et al. 2010). A meta-analysis investigated differences in effect between Acamprosate and naltrexone. For abstinence outcomes, the overall effect size for Acamprosate studies ($g = 0.36$) was significantly larger than the overall effect size for naltrexone studies ($g = 0.12$) at end of treatment. Similar abstinence outcomes were also found at the last follow-up point after treatment ended. Naltrexone had a larger effect on heavy drinking outcomes ($g = 0.19$) compared with acamprosate ($g = 0.07$) at end of treatment (Maisel et al. 2013). *Nalmefene* is, as naltrexone, an opioid antagonist which is used as-needed (i.e., when the individual is tempted to or is planning to drink alcohol). In a meta-analysis of five RCTs (n = 2567) nalmefene treatment was associated with a reduction of 1.65 more binge-drinking days per month than placebo and a greater reduction in total alcohol consumption (standardized mean difference = 0.20) at six months (Palpacuer et al. 2015). *Baclofen* is a GABA-B receptor agonist which was originally approved for the treatment of spasticity. Activation of GABA-B receptors might reduce anxiety and help treat alcohol withdrawal and dependence. A Cochrane review did not find evidence of a difference between baclofen and placebo in any of the primary or secondary outcomes of the review (Minozzi et al. 2018). But a meta-analysis on data from 13 RCTs (n = 1492) showed that baclofen was associated with a significantly greater time to first lapse to drinking (standardized mean difference = 0.42) and a greater likelihood of abstinence during treatment (odds ratio = 1.93) than placebo (Pierce et al. 2018). Other pharmacological treatments that might reduce craving, lower consumption or increase abstinence among people with alcohol use disorders are varenicline, topiramate, sodium oxybate and metadoxine (Franck and Jayaram-Lindström 2013; Erwin and Slaton 2014; Caputo et al. 2016; Goh and Morgan 2017).

3.10 Behavioural and psychological treatments

A wide range of behavioural and psychological treatments are available for alcohol use disorder, and many treatments are equally effective in supporting abstinence or drinking reduction goals. Treatments with the greatest evidence of efficacy range from brief interventions, including MI (described above) to more extended cognitive behavioural treatments and twelve-step facilitation.

3.11 Twelve step

As AA is not really a treatment per se, a standardized program, Twelve Step Facilitation (TSF), is often used when scientifically evaluating effectiveness. TSF includes extended counselling, adopting some of the techniques and principles of AAs twelve-step program, as well as brief interventions designed to link individuals to AA groups in the community. The twelve-step program is intended to increase psychological well-being, improve interpersonal skills, enhance the ability to cope with stress, and facilitate adaptation to abstinence and a sober lifestyle. The program assumes that a patient needs to reach a state of insight in how the consequences of alcohol dependence have affected oneself and others. According to a Cochrane review published in 2006 the evidence for the effectiveness of AA and TSF is inconclusive, with selection bias as a common problem in evaluations (Ferri et al. 2006). A recent Cochrane review showed evidence from two RCTs that TSF can improve rates of continuous abstinence significantly at twelve-month follow-up (risk ratio 1.21) compared to other clinical interventions (e.g. CBT). TSF also seemed to performed as well as other clinical interventions in percent days abstinent at twelve-month follow-up according to low-certainty evidence from four studies (Kelly et al. 2020).

3.12 Cognitive Behavioural Therapies

Cognitive Behavioural Therapy (CBT) targets cognitive, affective, and environmental risks and situational cues for alcohol use and provide coping skills training to help an individual achieve and maintain abstinence or moderation. Applications in the field of alcohol use disorder are often based on *relapse prevention* (Marlatt and Donovan 2005) or *coping skills training* (Monti 2002). CBT is based on principles of conditioning and social learning theory. The concept of self-efficacy, or belief in one's ability to abstain from alcohol, plays an important role. CBT has a primary focus on identifying high-risk situations for drinking and then building a repertoire of coping skills to help patients approach risky situations without using alcohol. Much effort is placed on identifying positive and negative reinforcers of drinking and to replace these with non-alcohol related alternatives. The therapy sometimes also includes cue exposure with response prevention to extinguish association between alcohol cues and alcohol seeking or craving. Expectations regarding the effects of alcohol may also be identified and challenged. There are several different treatment manuals available for use with alcohol. (Magill et al. 2019). Mindfulness-based relapse prevention is a recent development that combine CBT with instruction on mindfulness skills and regular meditation practice. The goal is to help clients learn and apply mindfulness as a tool in preventing relapse

(Witkiewitz et al. 2005). CBTs are among the most extensively evaluated interventions for alcohol use disorders. In a meta-analysis of 53 studies for substance (alcohol or other drug) use a significant small overall effect (g = 0.15) was found compared to various controls (Magill and Ray 2009). A recent meta-analysis of CBT for substance use disorders reported significant effects with different contrasts and type of outcomes. Studies with minimal intervention, waitlist, or assessment only control conditions showed a pooled effect size of g = 0.58 for frequency outcomes and g = 0.67 for quantity outcomes at early follow-up. CBT in contrast to nonspecific therapy showed an effect size of g = 0.18 for frequency outcomes and g = 0.42 for quantity outcomes at early follow-up. In comparison with other specific therapy the effects of CBT were nonsignificant for both type of outcomes (Magill et al. 2019).

3.12.1 Behavioural self-control training

Some brief CBT interventions have been developed with the aim of facilitating self-change. For example, behavioural self-control training (BSCT) and guided self-change (Miller and Munoz 1982; Sobell and Sobell 1996). Most such self-help programs include goal-setting, self-monitoring of drinking behaviour, analysis of drinking situations, and learning alternate coping skills. They differ from other CBTs for alcohol use disorder in that they do not emphasize behavioural coping skills to the same extent as, for example relapse prevention or coping skills training. A meta-analysis of 17 studies BSCT indicated that this approach produced a moderate mean effect (d = 0.33) in reducing alcohol consumption compared to various controls. BSCT was found to be superior to no-contact control conditions (d = 0.94) but failed to achieve statistical significance relative to abstinence-oriented controls. It was found to be equally effective with alcohol dependent as with problem-drinking individuals (Walters 2000).

3.12.2 Behavioural couples therapy

Behavioural couples therapy and marital family therapy involve close family members in treatment and include analysis of drinking behaviours and of relationship factors that may influence drinking (i.e. communication, conflicts, and problem solving). They incorporate several behavioural techniques designed to reduce drinking and drinking-related problems as well as increasing caring behaviours, enhance communication, and improve relationship functioning. Skills training, contingency management, and behavioural contracting are also often components of these treatments (O'Farrell and Fals-Stewart 2003). A meta-analysis of behavioural couples, marital, and family therapy found a clear overall advantage compared to individual-based treatments across outcome domains (frequency of use d = 0.36, consequences of use d = 0.52, and relationship satisfaction d = 0.57) (Powers et al. 2008).

3.12.3 Contingency management

Following the principles of operant conditioning, contingency management (CM) uses reinforcing consequences to alter substance use behaviour. Usually by providing tangible reinforcers for abstinence in the form of vouchers for goods or services (e.g. a movie ticket). A

meta-analysis has shown a moderate mean effect size of CM (d = 0.42) (Prendergast et al. 2002).

3.12.4 Community Reinforcement Approach

Community Reinforcement Approach (CRA) is an approach that combines elements of CBT, MI, pharmacological treatment (disulfiram), couples therapy and social work (Smith and Meyers 2001). CRA is based on operant conditioning and the theoretical view that substance-related reinforcers and the relative lack of alternative reinforcers unrelated to alcohol use maintain the disorder. The development of alternative rewarding activities that are incompatible with alcohol use are important to and maintain abstinence. Emphasis is placed on changing environmental contingencies in the different aspects of life (e.g. work, recreation, family) to promote a lifestyle that is more rewarding than continued alcohol use. CRA usually includes: functional analysis of drinking, sobriety sampling, treatment plan behavioural skills training, problem solving, communication skills, drink refusal, job skills training, social and recreational counselling, relationship counselling and relapse prevention. A review found evidence, provided by multiple high quality RCTs, that CRAFT is more effective than usual care in reducing number of drinking days (Roozen et al. 2004).

3.13 Other psychological treatments

Outside of CBT and TSF there are several psychological treatments for alcohol use disorders that only have showed promising results in single studies, like Psychoanalytic-interactional therapy (Nyhuis et al. 2018), Solution-focused brief therapy (González Suitt et al. 2019) and Social behaviour and network therapy (Orford 2005)

3.14 Predictors of outcome in treatment of alcohol use disorder

Successfully identifying predictors of treatment outcome in alcohol treatment has proven to be difficult. In a large UK trial, different predictors were identified for different drinking outcomes (Dale et al. 2017). According to a systematic review, few predictor variables were examined in more than a third of predictor studies of alcohol treatment, and few variables were found to be significant predictors consistently in a majority of studies. The most consistent predictors overall were low severity of alcohol dependency, low psychiatric comorbidity, high self-efficacy, high motivation and abstinence goal (Adamson et al. 2009).

3.15 Effective components of treatment

According to an emergent theory of Motivational Interviewing (MI) there are two specific active components: a relational component focused on empathy and the interpersonal spirit of MI, and a technical component involving the differential evocation and reinforcement of client change talk. The idea is that the individual can talk themselves into changing in a direction that they intrinsically desire or values. The therapist guides the person in an empathic way in this direction (Miller and Rose 2009). But this should always be done within

the explicit boundaries of their area of work. A review of mechanisms of change in MI found consistent evidence for three constructs: client change talk/intention is related to better outcomes; client experience of discrepancy is related to better outcomes; and therapist MI-inconsistent behaviour (i.e. confrontation, labelling, blaming) is related to worse outcomes (Apodaca and Longabaugh 2009) In a meta-analysis, therapist MI-consistent skills were correlated with more patient change talk as well as more sustain talk. MI-inconsistent skills were correlated with more sustain talk, but not change talk. The proportion of MI consistency was related to higher proportion change talk and higher proportion change talk was related to reductions in risk behaviour at follow up. Patient sustain talk was positively associated with worse outcome (Magill et al. 2018). In one study, written change-responses were also found to be associated with increased motivation and change in drinking behaviour change (Collins et al. 2005).

In a review of behaviour change techniques (BCTs) to reduce excessive alcohol consumption, 42 BCTs were identified from guidance documents and treatment manuals. Analyses revealed that brief interventions that included the BCT 'prompt self-recording' were associated with larger effect sizes. (Michie et al. 2012). A meta-analytic review showed that AA attendance increased social support and increased support increased later abstinence (Magill et al. 2015). The acquisition of and improvement in coping skills and self-efficacy have support as mediators of CBT's effect on a range of treatment outcomes. But despite continued effort during past decades to identify active ingredients and mechanisms of behaviour change in CBT for alcohol use disorder, consistent support has not been found (Magill et al. 2015). Analysis of data from a RCT that combined pharmacotherapy with behavioural intervention for alcohol dependence, showed that participants who received drink refusal skills training had significantly fewer drinking days during treatment and up to one year following treatment ($d = 0.23$). Increased self-efficacy was found to mediate the relationship between drink refusal training and drinking outcomes (Witkiewitz et al. 2012). In a second study changes in negative mood were significantly associated with changes in heavy drinking during treatment. Participants who received a craving module had significantly fewer heavy drinking days during treatment ($d = 0.31$), and receiving the module moderated the relation between negative mood and heavy drinking during treatment and one year after treatment (Witkiewitz et al. 2011).

3.16 General findings about treatment effects in alcohol treatment

As described above there is a range of different treatment options for people with alcohol use disorder that have shown to be effective in reducing alcohol use compared to placebo or minimal controls. But intensity may not be related to outcome. Intensive clinical treatments, such as CBT or TSF, are not necessarily more effective than less intensive treatments such as SBI or MI. Research from the last decades have also seen several large trials that have failed to find differential effects, when comparing different specified treatments (Anton et al. 2006; Allen et al. 1997; Orford 2005).

A meta-analysis found that comparisons of different psychological treatments for alcohol use disorder yielded a common effect size that was not significantly different from zero for alcohol consumption measures or for measures of abstinence. According to Imel et al. research that looks beyond the therapeutic rationale when looking for the mechanisms of change, to potentially more universal change factors, may be beneficial (Imel et al. 2008). Even if outcome studies tend to find small to no difference when specific treatment methods are compared with each other, but usually show substantial differences between therapists in client outcomes. Relational factors such as therapist empathy and therapeutic alliance can be significant determinants of treatment outcome and should according to Miller and Moyers not be regarded as common or non-specific, but specified and incorporated into clinical research and training (Miller and Moyers 2015). But there could also be important factors explaining the effects of therapy that vary for the same therapist with each patient.

3.17 Therapeutic Alliance

Alliance between the patient and the therapist has been shown to have an impact on outcome in psychological interventions, regardless of psychotherapeutic orientation (Flückiger et al. 2018; Meier et al. 2005). According to Rogers, good working alliance requires that the therapist has an unconditionally positive regard for the client and that the therapist conveys empathy, warmth and congruency towards the client (Rogers 1957). In Motivational Interviewing the relationship is characterized by empathy, partnership, and support of the patient's autonomy (Moyers 2014). According to Bordin, alliance is based on the cooperation and shared view between patient and therapist and it is composed of three components: the bond (mutual trust and acceptance), the agreement about the goals and the agreement about the tasks for therapy (Bordin 1979).

3.18 The treatment gap

The difference between the number of individuals affected by a condition and the number in treatment is usually referred to as the treatment gap. Alcohol use disorder has one of the largest treatment gaps compared to other psychiatric disorders (Kohn et al. 2004). Estimates from 26 countries worldwide suggest only seven percent of individuals with substance use disorders receive treatment (Degenhardt et al. 2017). Among primary care patients in six European countries, less than one in five individuals with alcohol dependence were in treatment (Rehm et al. 2015). Prevalence of lifetime use of alcohol treatment have been shown to be 25% among those with a lifetime diagnosis of alcohol dependence (Cunningham and Blomqvist 2006). Individuals in treatment typically have a higher alcohol consumption, more severe alcohol use disorder, more co-morbid disorders and are less well socially integrated (Rehm et al. 2015; Storbjörk and Room 2008). Epidemiological models have estimated that 12 000 lives in the EU could be saved annually be raising the treatment coverage for alcohol use disorder from 10% to 40%. The alcohol-attributable mortality would be reduced by 13% for men and 9% for women. This would mean that 10000 male and 1700 female deaths would be avoided annually (Rehm et al. 2013)

3.19 Barriers to treatment

In order to decrease the treatment gap, there is a need to understand why individuals with alcohol use disorder do not seek treatment. Barriers to seeking treatment can be person-related, such as not recognizing one's alcohol use as problematic or feelings of shame, or treatment-related, like lack of available treatment or lack of confidence in treatment. Person-related barriers are most common early in the process, when the individual is recognizing an alcohol problem and may decide to change. A combination of person-related and treatment-related barriers are important when deciding that treatment is needed or when actually seeking treatment (Saunders 2006; Grant 1997). In a study that examined self-reported reasons for not seeking treatment among primary health care patients with alcohol use disorder, the most frequent reason was that they did not consider their alcohol use a problem (55.3 %), the second most common was stigma or shame (28.6 %), followed by encounter barriers (e.g. lack of time or possibility, 22.8 %) and wanting to handle the problem on their own (20.9 %) (Probst et al. 2015).

As mentioned, survey data demonstrate that many people with alcohol use disorder recover on their own. At the same time many regards alcohol use disorder as a chronic disorder that requires treatment. But when people with alcohol use disorder are asked why they have not sought treatment many say that they can or should be strong enough to handle it on their own (Schuler et al. 2015). According to a cross-sectional, interview survey of the Swedish general population respondents rated 'feeling ashamed' as the most important reason why people would not seek help for alcohol problems (Andréasson et al. 2013). Both suffering from alcohol use disorder, as well as realizing the need for and entering treatment, were associated with shame and stigma, and were regarded as strong barriers to treatment by people with alcohol use disorder interviewed in Swedish focus groups (Wallhed Finn 2014).

3.20 Stigma

Stigma is a social process characterized by exclusion, rejection, blame or devaluation that results from experience, perception or reasonable anticipation of an adverse social judgment about a person or group. Health-related stigma is typically characterized by social disqualification of individuals and populations who are identified with particular health problems (Weiss et al. 2006). In the western world alcohol use disorder is one of the psychiatric disorders that are most stigmatized (Schomerus et al. 2011). Individuals with alcohol use disorder elicit more social rejection, more negative emotions and are viewed as being more responsible for their disorder compared to other disorders. This stigmatization has been found stable over time. The view that alcohol dependence is associated with being irresponsible is an important component of the stigma (Schomerus et al. 2014). A person may internalize the public stigma of a medical condition, a process called self-stigma. Self-stigma among people with alcohol use disorder has been shown to lead to lower self-efficacy and lower drinking-refusal skills (Schomerus, Corrigan, et al. 2011).

3.21 Moderation or sobriety

One treatment-related barrier to treatment of alcohol use disorder is that many individuals refrains from treatment when the only goal is sobriety (Probst et al. 2015; Wallhed Finn et al. 2014). Many individuals that seek treatment for problematic alcohol use wish to reduce their drinking to a safer level, rather than abstain completely (Orford 2005; Heather et al. 2010) The individual goal of treatment for alcohol use disorder is debated, and different views are often expressed. Proponents for some treatment directions advocate total sobriety, while others support moderate alcohol consumption as a viable treatment goal. In the population, it is common to recover from alcohol use disorder without becoming totally abstinent (Fan et al. 2019). One example is a prospective cohort study in the Netherlands where only nine percent, of those who recovered from alcohol dependence after three-years, abstained completely from alcohol. (Tuithof et al. 2013) There are also several psychological treatments for alcohol use disorder, like behavioural self-control training and guided self-control training that have been successful in supporting moderate drinking goals (Witkiewitz and Marlatt 2006).

3.22 The Swedish treatment system for alcohol use disorders

Treatment for alcohol use disorders are offered for all Swedes at low cost via health care or social services. In Sweden, the municipalities are responsible for meeting and financing the treatment needs of residents. The responsibility for assessing the need for treatment of individuals with problematic alcohol use, for planning treatment and for follow up, lies with municipal social services (Social Services Act, 2001). When individuals are at risk of destroying their lives or seriously harming themselves or others by using substances, but are not willing to undergo necessary treatment when offered, can be forced to involuntary treatment (Care of Abusers (Special Provisions) Act, 1988). The regional health care is responsible for medical treatment. Including acute withdrawal, pharmacological treatment and treatment for different medical complications due to high alcohol consumption, e.g. liver disease, neurological disorders, affective disorders (Health and Medical Services Act). Thus, the responsibility for treatment of alcohol use disorders is shared/divided between municipal social services and the regional health care. Services offered vary considerably between municipalities and regions in Sweden, but usually include some form of outpatient counselling. Residential treatment, provided by private companies or no-profit providers can be financed by the municipality on individual basis after lengthy assessment. Swedish employers usually offer employees treatment via the Occupational Health Service.

4 Digital interventions for alcohol

4.1 The use of Internet for health information

When internet and the world wide web were developed four decades ago it was an alternative way of finding information that was used by only the most interested. The common way of finding health-related information, like information on the consequences of alcohol use or information about treatment options, was directly from professionals, through books or word of mouth. Today 95% of the population in Sweden use the internet and 91% use it daily, which puts Sweden in a leading position in the world when it comes to internet use. Internet was rated as the most important source of information in 2016. More than 85% of Swedes use internet to find information about health or medicine and about 40% do it at least every month. Digital services for health care are used by 53% of Swedes and 10% use them instead of visiting health care (Internetstiftelsen 2019).

4.2 Information and help regarding alcohol use via internet

In a survey conducted in 2009 by the Swedish National Institute of Public Health, 78% of respondents stated that it was likely or very likely that they would use Internet to obtain information about alcohol and illicit drugs, but only 31 said it was likely or very likely that they would ask a health care professional (The Swedish National Institute of Public Health 2009). Individuals with alcohol dependence who participated in a Swedish focus-group and interview study indicated Internet as an attractive first step for assessment of alcohol use and guidance to treatment but not for actual treatment (Wallhed Finn 2014). A recent global drug survey shows that people in English speaking countries, with moderate alcohol problems prefer getting help from internet tools (Davies et al. 2019). Early research showed that a sample of problematic alcohol users would rather use internet-based self-help tools than being contacted via the telephone by a live therapist or using a self-help book (Koski-Jännes and Cunningham 2001). A general population survey in Canada also found that current drinkers were more likely to have home access to internet than abstainers (73 vs 50%) (Cunningham et al. 2006).

4.3 Digital, Internet and web-based interventions

There are a large number of terms referring to the use of information technology in health care and prevention. Digital tools can be used by both professionals and end users (e.g. patients). For the purposes of this thesis we will use the term *digital intervention* for interventions that target the individual user directly with prevention or treatment and is delivered to a computer, a phone or a tablet via a dedicated program, application or through a web-browser. The term *internet interventions* will be used to refer to digital interventions that are delivered through the internet via web-browsers or applications (apps). Web-based interventions are internet interventions that are accessed via a web-browser. An internet intervention

is more than a website with information. It involves interactive features like exercises, assessment or self-monitoring and sometimes support from a therapist or from peers (Ritterband and Thorndike 2006).

4.4 Different types of internet alcohol interventions

An internet alcohol intervention is referring to an internet intervention with the aim of supporting the user in cutting down or quit drinking alcohol. The interventions can be similar to brief interventions but can also be a more extended program and contain similar content as psychological treatment (Cunningham et al. 2011).

4.4.1 Electronic screening and brief interventions

The most studied internet alcohol intervention is the electronic screening and brief intervention (eSBI). Such interventions typically do not take more than ten to fifteen minutes to complete, usually in one session. They are primarily intended for those who are at risk of developing problems and based on the same theoretical framework and content as face-to-face brief interventions. eSBIs usually consist of a series questions about drinking and automatic personalized feedback based on the user's answers. The user is informed about their risk of developing alcohol-related problems and how their alcohol consumption compares to norm groups. Participants are then given some standard suggestions or tips on how to reduce their alcohol consumption. eSBIs have been shown to be effective in reducing weekly alcohol consumption as well as binge drinking intensity and frequency with reductions sustained for up to twelve months (Tansil et al. 2016; Donoghue et al. 2014). eSBIs that are directed to specific groups are mostly addressed to college students. A review of controlled trials from 2010 to 2016 showed that eSBIs for college students were associated with very small but significant reductions in quantity and frequency of alcohol consumption at short-term, but significantly more alcohol-related problems at long-term follow-ups when compared with controls (Cole et al. 2018).

4.4.2 Internet alcohol programs

The focus of this thesis is internet alcohol interventions that offer similar content to what is used in face-to-face treatments and that are designed for use on several occasions. The distinction between brief interventions and extended programs is not very easy to make. Brief does not just refer to the time the intervention is intended to be used. Some interventions offering screening and personalized feedback can be very extensive and take some time to complete or be used on several occasions while interventions offering structured treatment content do not necessarily need to be long or multi-sessional, depending on how the users of the interventions chose to use them (Cunningham et al. 2011). The purpose of internet alcohol programs usually is to decrease alcohol consumption and alcohol-related problems among users that experience at least some problems, rather than preventing individuals at risk from getting problems. In this thesis such extended interventions are referred to as

internet programs. Internet programs that are based on principles of Cognitive Behavioural Therapy and are intended to be used continually for a number of sessions are often referred to as *Internet Cognitive Behavioural Therapy* (ICBT). Compared to single-session interventions, effect sizes for more extended programs seem to be somewhat larger (Riper et al. 2011, 2018)

4.4.3 Guided or self-help interventions

Another important distinction when describing internet interventions is by the extent to which the users have contact with a counsellor or therapist. Most internet alcohol interventions have been pure self-help, without any personal contact during the intervention. Other interventions have been assisted self-help where a person introduces the user on how to use the internet intervention or remind them to do so. In guided internet interventions, the user of the intervention has contact with a therapist or counsellor during the intervention time via electronic communication. In this thesis guided internet programs are sometimes, especially in Study III and IV, referred to as *internet treatment*. When an internet program is a complement to ordinary face-to-face treatment it is usually called *blended* treatment. Internet alcohol interventions have shown larger effects on alcohol use with guidance than without (Riper et al. 2018), but these results are based on few studies and a mix of brief- and extended internet interventions. Internet alcohol interventions have mostly been used as part of a public health tradition for secondary prevention, to attract people in the general population who may not yet realize that they have a problem or who for some reason are reluctant to seek help within the health care system. Compared to internet interventions for other psychiatric or somatic disorders which have been developed from a clinical perspective, there has been a lack of diagnostic assessments and fewer interventions involving therapist guidance.

4.5 Perceived advantages of internet interventions

The most commonly mentioned advantage of internet intervention is the possibility to overcome some of the barriers for treatment that have been mentioned above (Kypri et al. 2005). Stigma and embarrassment or fear of negative consequences from being registered as having alcohol problems can be handled by the relative anonymity and by not having to visit a clinic, were others can see you go in or you have to talk directly with health care professional about your alcohol use. They are also accessible anytime and anywhere for people who have difficulties getting time of work, leave home or live in rural areas. The possibility to be anonymous is more frequently stressed in the alcohol internet interventions literature (Cunningham et al. 2011), while accessibility is more commonly referred to in the depression and anxiety internet interventions literature (Andersson 2010). Another advantage also connected to the easy access is that the level of motivation to change a problematic behaviour such as problematic alcohol use varies over time. Whenever an individual feels ready to consider changing their drinking behaviour an internet intervention can be immediately available to be utilized in that window of opportunity (Cloud and Peacock 2001; Hester and Miller 2006). There is a potential for cost-efficiency. The cost for maintenance is quite low after developing an Internet intervention and the cost for delivering an Internet intervention do not necessarily

increase with increased numbers of users (Hester and Miller 2006). If modification of the intervention is needed, the changes are carried out just once and instantly implemented. When delivering Internet-based self-help interventions without therapist support, the cost for education, training and supervision of the clinicians are also avoided (Copeland 2011).

Using the Internet may also increase access to evidence-based interventions for a larger number of people (Cunningham 2011). Internet interventions can provide more consistent delivery of the intervention, which cannot be modified by individual therapists as with manual-based live therapies. Computer support can increase therapist adherence to treatment protocols, increase the number of practitioners who can use evidence-based programs, and decrease therapist drift from manualized treatments (Andersson 2010). From a researcher perspective, internet interventions can also facilitate rapid clinical innovation, shorter study periods, easier recruitment and large sample sizes (Andersson 2019). The advantage of Internet interventions as self-help tools over material such as videos and written materials is the possibility of adapting the intervention to each user according to different variables such as age, comorbid disorders or other dimensions like user process or preferences. Previous research has shown that the effects of an intervention are greater when adapted to individuals (Kreuter et al. 1999; Noar et al. 2007). Internet interventions allow the tailoring and accommodation of the intervention components which can be used with for example comorbid disorders (Johansson et al. 2012).

4.5.1 Perceived advantages from a user perspective

In an interview study, the users of an internet self-help intervention aimed at reducing alcohol consumption said that the perceived privacy of the internet was important in searching for help and avoid stigma and embarrassment (Khadjesari et al. 2015). In focus groups with students regarding their perceptions towards using digital interventions to prevent high-risk drinking, the students expressed that drink-tracking and notifications were useful features (Kazemi et al. 2014). People who use an online mutual aid group describe that such groups may serve as a place for them to explore their relationship with alcohol at early stages of change (Chambers et al. 2017). Users of internet interventions outside of the alcohol field have appreciated the enhanced anonymity (Holst et al. 2017). Such users have also described the flexibility as an important advantage with easy access without traveling and at any time. The increased personal responsibility that comes with that flexibility gave them a sense of autonomy and empowerment (Verhoeks et al. 2017). The evidence of these advantages of internet interventions are still in many cases incomplete. But internet interventions aimed at reducing alcohol problems have been shown to reach those who have alcohol use disorders but do not come into contact with specialized services (Sinadinovic 2010, White 2010) and have shown promising results in terms of cost-effectiveness (Donker et al. 2015; Blankers et al. 2012).

4.6 Swedish internet interventions for alcohol

The first Swedish internet intervention for alcohol use was developed at the STAD prevention project in the beginning of the 21th century. The program was an online CBT-based intervention that could be used over a modem connection. The program was active during 2002-2003 (http://web.archive.org/web/20020925170737/www.sjalvhjalp.stad.org/). See figure 5 for screenshots of Swedish internet intervention for alcohol use.

In 2003 an electronic screening and brief intervention (eSBI) freely available on the internet was launched by Alkoholkommittén [the alcohol-committee], a governmental prevention project. The internet intervention, called Alkoholprofilen [the alcohol-profile] provided screening, normative feedback, motivational questions and the opportunity to compare your alcohol consumption with your friends through social media without showing each individual result (https://alkoholprofilen.se). A cross-sectional survey among 18-25-year old's in the general population (n = 1414) repeated in 2004 and 2005 showed that 42% had tried the intervention. Participants who drank more were more likely to have used the intervention than participants who drank less alcohol. Also, participants who were considering changing their drinking were more likely to have used the intervention than those who did not. No clear effect on alcohol consumption was detected among those who had done the eSBI in 2004 compared to those who had not used it (Sjölund 2007).

In light of the popularity of Alkoholprofilen a decision was made by the alcohol-committee to also develop a more extended internet intervention for those who wanted to change their drinking and concerned others. In the end of 2006 the first version of Alkoholhjälpen [the alcohol-help] was launched (https://alkoholhjalpen.se). The program was based on Cognitive Behaviour Treatment (CBT), Motivational Interviewing (MI) and solution-focused brief therapy and also offered interaction with other users in an open discussion-forum. This intervention was freely available via the Internet. Shorter interventions based on Community Reinforcement Approach Family Training was offered to family and friends respectively.

In 2007 another Swedish eSBI aimed at alcohol as well as drug-use (https://escreen.se) was launched. The intervention offered self-assessment of alcohol and drug use the Alcohol Use Disorders Identification Test (AUDIT) and the Drug Use Disorders Identification Test (DUDIT) as well as in-depth risk assessment. Users receive individualized feedback concerning their alcohol and drug consumption, comparisons with normative data and the possibility of following their alcohol and drug use over time, if screening was repeated. In a study describing user characteristics of 2361 individuals, with a mean age of 23 years, 67.4% indicated problematic alcohol use and 46.0% indicated problematic drug use. (Sinadinovic et al. 2010). An in-depth description of eScreen can be found in Sinadinovics thesis (Sinadinovic 2012).

Access to the eScreen brief intervention or the Alkoholhjälpen extended intervention were compared with assessment only in a randomized controlled trial 2009-2010. Participants

were 633 internet help seekers with at least hazardous alcohol use (Alcohol Use Disorders Identification Test, AUDIT ≥6 for women and ≥8 for men). All groups reduced their alcohol use at three months follow-up ($p < 0.001$), remaining stable at the six- and twelve months follow-ups according to AUDIT-C and AUDIT-scores. No significant differences were found between the groups in the intention-to-treat analysis. Per protocol analysis, including only participants who accessed the interventions and also reported accessing additional external support during the trial, showed that about 75% of Alkoholhjälpen participants moved from probable dependence, harmful or hazardous use to a lower alcohol level of alcohol use at three, six- and twelve-month follow-ups, compared to about 40-60% of eScreen users and controls ($p < 0.05$) (Sinadinovic et al. 2014).

In Swedish universities an electronic screening and brief intervention (eSBI), were students are invited via their university email, have been developed and tested. In a blinded RCT of the intervention 5227 students were randomized to alcohol assessment and feedback, alcohol assessment without feedback, and neither assessment nor feedback. No differences between groups was found in any of the alcohol parameters at follow-up two months later. Per protocol analyses suggested possible small beneficial effects on weekly consumption attributable to feedback (Bendtsen et al. 2012). In a second randomised controlled trail (RCT) risky drinkers at nine universities in Sweden (n = 1605). were randomized into immediate or delayed access to the eSBI. After two months, there were no significant differences in the planned analyses, and with some indication of possible benefit in sensitivity analyses suggesting an intervention effect of a 10% reduction in weekly alcohol consumption (Bendtsen et al. 2015).

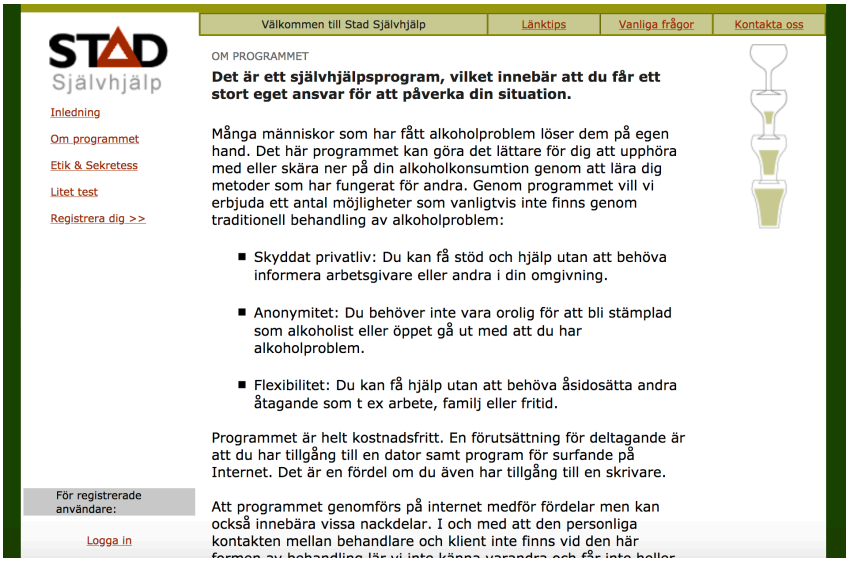
Another Swedish brief intervention intended to reduce peak blood alcohol concentrations (BAC) in university students. A total of 1,678 hazardous-drinking consumers were randomized to a single or a repeated Internet or Interactive Voice Response intervention, or to a control group. At follow-up It was found that peak estimated BAC was reduced in all internet and Interactive Voice Response groups, compared to control. The reduction in peak estimated BAC was greater in the single internet group compared to the single Interactive Voice Response group (Andersson 2015).

When the old flash-based program Alkoholhjälpen was closed down in 2010 a translated and adapted version of a program used in a previous Dutch study was tested in a pilot study (n = 80). The program called eChange had eight-modules and was based on MI and CBT. Eighty participants with hazardous alcohol use who searched for support at Alkoholhjälpen were randomized into three different groups. All groups were offered the same extended program, but with therapist guidance via asynchronous text messages, with therapist guidance via synchronous chat or without therapist guidance. Intention-to-treat analysis at ten weeks follow-up, showed that participants in the two guidance groups reported significantly lower past week alcohol consumption compared to the group without guidance; 10.8 (SD = 12.1) versus 22.6 (SD = 18.4); p = 0.001; d = 0.77 (Sundström et al. 2016).

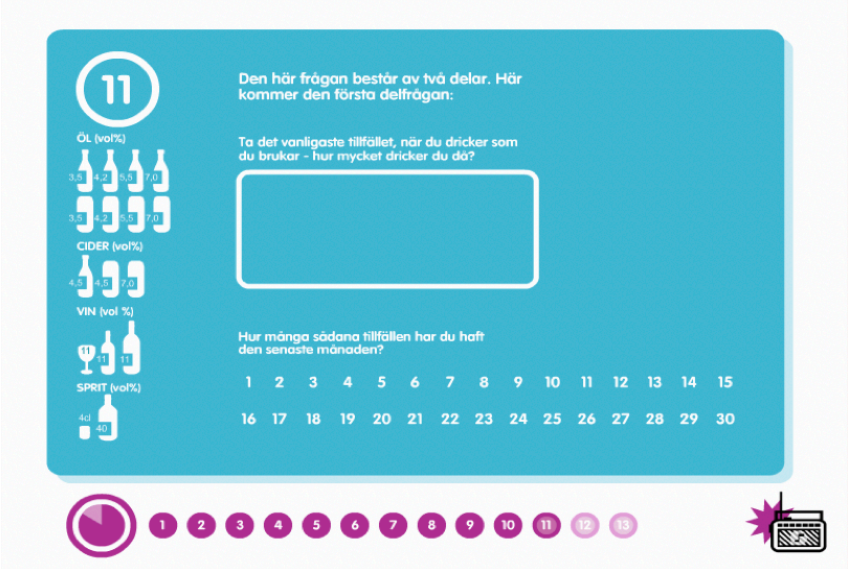
Alongside the projects in the current thesis, Sundström and colleagues developed and tested a high-intensity therapist-guided 12-week internet intervention for alcohol based on relapse prevention (entitled ePlus) (Sundström et al. 2017). The high-intensity therapist-guided internet intervention was compared with a low-intensity internet self-help intervention (eChange) and a waiting list in a RCT. A total of 166 online self-referred adults (49% males) were randomized at a 7:7:2 ratio. Diagnostic interviews with participants showed that alcohol use disorders were largely in the severe category and the majority having had alcohol problems for more than five years. At the six months follow-up, an intent-to-treat analysis showed no significant differences in alcohol consumption between the high- and low-intensity interventions. At post-treatment (twelve weeks) both the high and low-intensity internet intervention groups had reduced their alcohol consumption more than control (Sundström et al. 2019). More information on this project can also be found in Sundströms thesis (Sundström 2017).

Mobile applications (apps) have been used for delivering digital interventions in two Swedish studies so far. One study tested two apps offering real-time estimated blood alcohol concentration calculation to reduce problematic alcohol intake. Students at two universities were recruited via e-mails and 1932 were randomized to the Swedish government alcohol monopoly's app (Promillekoll) to a web-based app developed by the research group (Party Planner) or to control. None of the apps showed reduced consumption at seven weeks follow-up. Self-reported app use was higher with Promillekoll (74%) compared to Party Planner (41%) and the per-protocol analyses revealed that Promillekoll participants also increased the frequency of drinking occasions compared to controls (Gajecki et al. 2014). In a second study students ($n = 186$) with excessive alcohol consumption were randomized to a skills training app group or a wait list group. Assessment-only controls ($n = 144$) with excessive alcohol consumption from an ongoing study were used as controls. The proportion of participants with excessive alcohol consumption declined in both groups compared to control at six and twelve weeks second follow-ups. Secondary analyses showed significant reductions for the skills training app group in quantity of drinking at first follow-up and in frequency of drinking at both follow-ups (Gajecki et al. 2017)

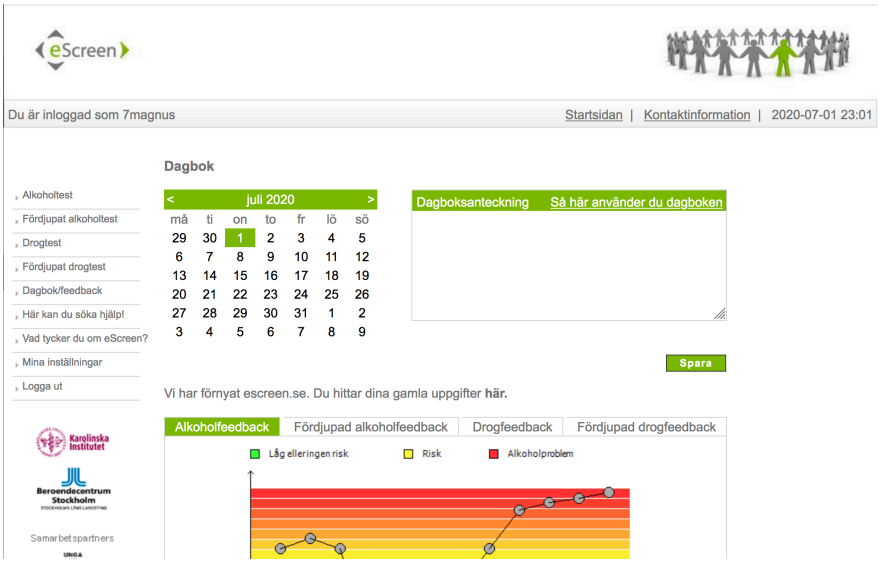
Figure 5. Screenshots of STAD, Alkoholprofilen, eScreen, Alkoholhjälpen and eChange



STAD självhjälp
[STAD self-help]
2002

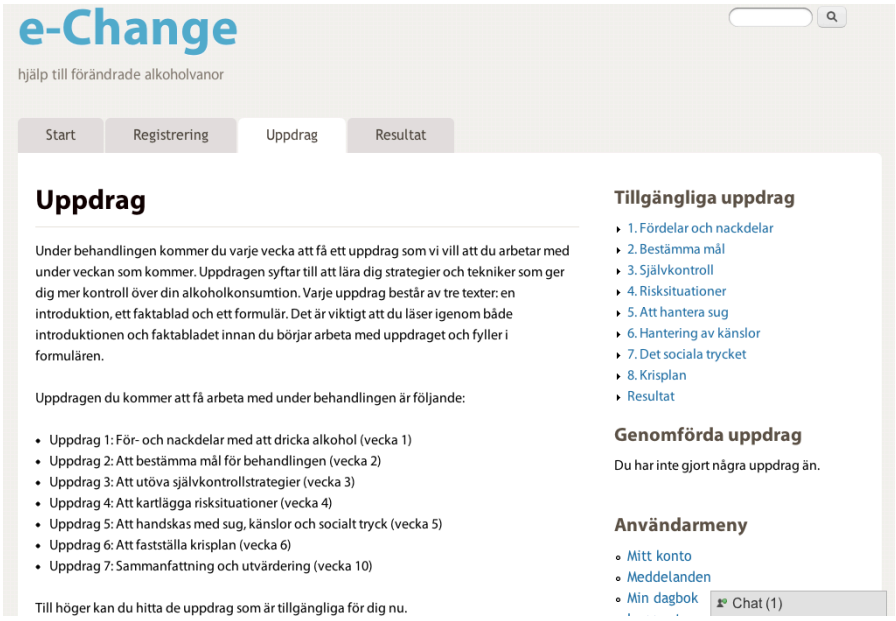


Alkoholprofilen
[the alcohol-profile]
2003



eScreen

Alkoholhjälpen
[the alcohol-help]
2007



eChange
2010

Promillekoll
[BAC-track]
2014

4.7 Previous research on extended digital interventions for alcohol

A large number of reviews have been published on internet alcohol interventions. A review of 14 systematic reviews of digital interventions for problematic alcohol use show that none of the included reviews addressed the association between length of intervention or guidance, and effects on alcohol consumption (Sundström et al. 2017). For the purpose of this thesis a separate review of extended digital interventions for alcohol was conducted. Digital interventions on computers, web and phones used in clinical as well as in general population settings were included. The aim of the review was to investigate the effects of extended digital interventions designed to reduce alcohol consumption or alcohol related problems. PubMed, Web of Science and PsychINFO were searched for studies investigating the effects of digital interventions aimed at reducing alcohol use from database inception to 15 November 2015, using the search terms "internet", "web", "online", "computer", "mobile" or "phone" and "alcohol" or "drinking" and "intervention", "treatment" or "therapy". The reference lists of reviews and dissertations were screened for additional references. A summary of the findings from this review is presented and discussed below. A total of 1002 entries, 617 unique articles were identified. A majority of the studies identified were conducted on brief single-session interventions aimed at students or similar risk populations. In 54 studies that were included in this review, the focus was on effects of extended digital interventions. Details of the studies are reported in table 4a and b.

Among the included studies, RCT was the most common type (39 studies), other types were pilots, quasi-experimental studies, observation studies, cohort studies, outcome evaluation and mixed method. Several of the studies were labelled as pragmatic. All studies except one were conducted in Western, high income countries. Most common countries were USA (n = 23) and Netherlands (n = 9). The first study was published in 1997. After that it took ten years until the next study was published in 2007. The number of articles published per five-year period increased from 19 articles in 2008-2012 to 49 articles between 2013-2017. Studies were usually published 2-3 years after the study was conducted, but in some cases, it took five years or more. In 15 of the studies it was not reported when the study of the intervention was conducted. The increasing number of studies over time could be a sign of the technology becoming more stable and of the more widespread use of computers, internet and smartphones in high income countries. Since internet interventions are based on technology which is changing rapidly, the information about when the study was conducted is important to be able to understand the results reported and their implication for future interventions and studies.

The mean age of participants over all studies was 40 years and 45% of the participants were women. The relatively high mean age is interesting since digital interventions have been thought to be a way of reaching a younger population, which have high alcohol consumption but low rates of treatment seeking. Most of the studies had drinking hazardous or above guidelines as criteria for inclusion. In clinic-based studies, were participants were not using alcohol at recruitment, the inclusion instead was diagnosed alcohol use disorder. Exclusion criteria were usually minimal. In all the included studies the participants were drinking at

least at hazardous levels. The mean consumption or AUDIT-score of participants in the individual studies corresponded with harmful use or probable dependence.

Half of the studies identified were conducted primarily on the internet. In some of these studies the participant were contacted via phone or postal mail as a part of the screening or follow-up. Fifteen studies have been in a clinical setting, during or after treatment. Most of the interventions in this review were self-help and did not include any support, guidance or therapy from a counsellor. Only eight studies had regular contact with a therapist over the internet and could be categorized as guided programs. Some of the studies provided face-to-face support on how to use the intervention from treatment- or research-staff.

The interventions usually included from two to twenty sessions or weeks of program. The most common method used was a combination of MI and CBT. Some of the more recent developed interventions included location-based monitoring used in smart-phones and computerized cognitive bias modification programs. Several of the interventions that were publicly available were accessed during the review. These interventions were usually well described in the articles.

With few exceptions' studies reported how much of the intervention that was used. The number and length of follow-up varied with three months being the most common one. In eight studies the participants were followed at least twelve months with changes in drinking usually remaining stable from earlier follow-ups. The overall mean attrition was 30%. Attrition rates were lower if a personal contact was included. Half of the studies did not report any user perceptions. In 16 studies satisfaction with intervention was reported as high. Two studies included measures of alliance. Information on what other help resources the participants had accessed in addition to the studied intervention was only reported in seven studies. In some studies only previous treatment were reported. This information is important to be able to understand the effect of internet interventions which are often provided and studied in a context where it is possible and even likely that participants use several sources of help to change their drinking. None of the studies reported information about non-responders and only included some information regarding adverse events. The quality of the RCT studies was rated as medium to high. Biggest source of bias was due to low retention in intervention usage or many participants lost to follow-up. Attrition bias was handled conservatively in most studies by imputation, usually of the last observation.

Table 4a Controlled studies on digital alcohol programs (>one session)

Author	Country	Recruit	n	Age	Women	Tech	Sess	Theory	Person contact	Control	FU mon
Acosta 2017	USA	Primary	162	36	7%	Web	12	CBT	no	TAU	3
Agyapong 2012	Ire	Resident	54	48	54%	Phone	12		no	Placebo	3
Andersson 2015	Swe	Student	1678	23	41%	Phone	2	CBT	no	Asses.	1.5
Blankers 2011	NL	Web	205	42	51%	Web	7	CBT, MI	guided	WL	6
Boß 2018	Ger	Web				Web		CBT	guided	Selfhelp, WL	
Brendryen 2017	Nor	Workpl	85	43	52%	Web	14	CBT	no	Booklet	6
Brendryen 2014	Nor	Web	244	38	33%	Web	14	CBT	no	Booklet	6
Brief 2013	USA	Web	600	32	13%	Web	8	MI, CBT	no	WL	3
Campbell 2014	USA	Clinic	507	35	38%	Comp.	12	CBT, CM	in tx	TAU	6
Carroll 2008	USA	Clinic	77	42	43%	Comp.	6	CBT	ass avail	TAU	6
Cunningham 2012	Can	Web	170	45	61%	Web	20	CBT, MI	group	Feedb.	6
Cunningham 2017	Can, USA	Web	490	37	50%	Web	20	CBT	no	SBI	24
Devine 2016	USA	Clinic	311	46	28%	Web	7	Medical adher.	in tx	Medical manage	3
Fals-Stewart 2010	USA	Clinic	160	33	42%	Comp	8	Cogn. Re-hab	ass avail	Placebo	12
Farren 2015	USA	Clinic	55	45	28%	Comp	5	CBT	in tx	Placebo	3
Finfgeld-Connett 2008	USA	Web	46	50	100%	Web	15	CBT	ass avail	Booklet	3
Gonzalez 2015	USA	Commun	60	35	40%	Phone	6	LBM, CBT	no	Booklet	1.5
Gonzalez 2015	USA	Clinic	80	20	29%	Phone	12	LBM, CBT	no	TAU	12
Gustafson 2014	USA	Resident	349	38	39%	Phone	n/a	LBM	in tx	TAU	12
Hester 1997	USA	Clinic	40	36	40%	Comp	8	CBT	ass avail	WL	12
Hester 2009	USA	Web	84	50	56%	Web	9	MM, CBT	start ass	Site	12
Hester 2013	USA	Web	189	44	66%	Web	5	CBT	no	Group	3
Kay-Lambkin 2009	Au	Clinic	97	35	54%	Web	9	CBT, MI	after ses	TAU	12
Kay-Lambkin 2011	Au	Clinic	274	40	43%	Comp	9	CBT, MI	after ses	TAU	3
Kiluk 2016	USA	Clinic	68	43	35%	Comp	6	CBT	in tx	TAU	6
Kramer 2009	NL	Commun	181	49	52%	Web+ DVD	5	CBT	no	WL	3
McGeary 2014	USA	Student	41	19	0%	Comp.	4	Probe	no	Placebo	1
Muench 2017	USA	Web	176	43	75%	Phone	12	Gain-loss	no	Placebo	3
Osilla et al. 2015	USA	Clinic	159	30	35%	Web	3	MI	no	TAU	3
Postel 2010	NL	Web	156	45	54%	Web	12	CBT, MI	guided	WL	9
Riper 2008	NL	Web	261	46	49%	Web	6	CBT	no	Booklet	6
Schulz 2013	Ger	Web	448	42	44%	Web	3	Planned Beh.	no	WL	6
Sinadinovic 2014	Swe	Web	633	44	55%	Web	15	CBT, MI	no	Asses.	12
Sundström 2019	Swe	Web				Web		CBT	guided	Selfhelp, WL	
Sundström 2016	Swe	Web	80	42	60%	Web	8	CBT	guided	Selfhelp	2.5
Tensil 2013	Ger	Web	595	30	39%	Web	2	CBT	no	SFT	3
Verduin 2013	USA	Clinic	41	51	0%	Comp	8	CBT	ass avail	Placebo	4
Wallace 2011	UK	Web	7935	38	57%	Web	3	CBT, MI	no	WL	12
Wiers 2015	NL	Web	314	48	46%	Web	4	Cogn. bias	no	Placebo	3

Table 4b Non-controlled studies on digital alcohol programs (>one session)

Author	Country	Setting	n	Age	Women	Tech	Sessions	Theory	Person. contact	FU mon
Andersson 2015	Swe	Student	1678	23	41%	Phone	2	CBT	no	1.5
Andrade 2016	Bra	Web	924	40	46%	Web	6	CBT	no	post
Barrio 2017	Esp	Clinic	24	48	50%	Phone	5	MI	ass avail	1.5
Blankers 2008	NL	Web	3386	40	41%	Web	7	CBT, MI	no	
Crombie 2017	UK	Commun	34		0%	Phone	4		no	post
Elison 2015	UK	Web	300	42	45%	Web	12	CBT	no	post
Fink 2016	USA	Commun	112	70	70%	Web	9	Health BM	no	1
Klein 2012	USA	Inpatient	1124	42	45%	Web	7	12-step	coach	12
Klein 2013	USA	Inpatient	1682	42	43%	Web	7	12-step	coach	6
Linke 2007	UK	Web	10000	37	51%	Web	6	CBT, MI	no	1.5
Postel 2010	NL	Web	527	46	49%	Web	12	CBT, MI	guided	6
Postel 2011	NL	Web	885	46	54%	Web	12	CBT, MI	guided	post
Riper 2009	NL	Web	378	45	53%	Web	6	CBT	no	6
Sinadinovic 2014	Swe	Web	633	44	55%	Web	15	CBT, MI	no	12
Sundström 2017	Swe	Web	13	49	69%	Web	12	CBT	guided	3

4.7.1 Web-based extended programs

Interventions accessible over the world wide web (web-based), aimed at the general public and based on CBT, BSCT and/or MI have been tested in 15 RCTs. Below is a short description of each of these studies.

4.7.2 Self-help

The Dutch self-help intervention at *minderdrinken.nl* is based on CBT and self-control principles. Users of the intervention were compared to a control group that had access to information on the effects of using alcohol in an RCT. A larger proportion of the Minderdrinken users (17.2%) did not have problematic alcohol use compared to the control group (5.4%) at six months follow-up. The decrease in alcohol consumption was significantly larger for the intervention group than the control group, with a difference of twelve standard units (= 120 g alcohol) (Riper et al. 2007). A study in a naturalistic setting showed similar decreases in the users alcohol consumption (Riper et al. 2009)

The British self-help intervention at *downyourdrink.org.uk is* based on MI and relapse prevention (Linke et al. 2008). The intervention was tested in a large randomized controlled trial with 7935 individuals with at least hazardous alcohol consumption, where the intervention was compared to a control group that received information on the consequences of alcohol consumption. A decrease in alcohol consumption was found at one, three- and twelve-months follow-up in both groups, but with no differences in alcohol use between the groups (Wallace et al. 2011).

The U.S. intervention moderatedrinking.com offer a self-help program with the aim of moderate drinking according to BSCT (Hester et al. 2009). Hester and colleagues tested the effects

of adding the intervention to support from the group network Moderation Management at moderation.org. Participants using moderatedrinking.com in combination with moderation.org were compared to those using only moderation.org. A decrease in alcohol consumption and alcohol-related problems at three, six- and twelve-month follow-up was found for both groups. Participants using both interventions increased their proportion of days abstinent more than participants using only moderation.org. (Pemberton et al. 2011)

Another U.S. intervention, *Overcoming Addictions* is an abstinence-oriented, internet CBT-intervention based on the program of *SMART Recovery*. SMART Recovery is an organization that use evidence-based treatment strategies in a mutual help framework with in-person meetings, online meetings, a forum, and other resources. The intervention was evaluated in an RCT with 189 participants who were new to SMART Recovery, that were randomized to receiving the Overcoming Addictions program, to attend SMART Recovery or to a combination of both. Participants in all three groups significantly increased their percent days abstinent, decreased their mean drinks per drinking day and decreased their alcohol-related problems at three months follow-up, but without significant differences between the groups (Hester et al. 2013).

An extended Internet intervention for alcohol problems, *Alcohol help center* (alcoholhelpcenter.net) was compared to an eSBI, Check Your Drinking, in two Canadian studies. The intervention contains CBT-tools modified from treatment and self-help manuals as well as a moderated online discussion group. A single-blinded RCT with a six months follow-up in a general population sample of problem drinkers found a significantly greater reduction in amount of drinking among participants provided access to the alcoholhelpcenter.net than among participants provided access to the eSBI (Cunningham 2012). A second larger RCT could not provide support for the added benefit of an extended internet alcohol intervention over an eSBI. Analyses of the six-, twelve- and twenty-four-month follow-up revealed no significant differences between interventions in alcohol consumption-measures (Cunningham et al. 2017).

A Norwegian intensive self-help program *Balance,* with 62 fully automated interactive sessions, was compared to information on the effects of alcohol in a RCT. Participants in both conditions received an online single session screening procedure including personalized normative feedback. At-risk drinkers were recruited by internet advertisements and assigned randomly to one of the two conditions (n = 244). Participants in the intensive self-help group drank an average of three fewer standard drinks (= 36 g of alcohol) compared to participants in the brief self-help group at six months (Brendryen et al. 2014). In a second study, where hazardous drinking participants were recruited in a workplace setting, the findings were inconclusive due to recruitment problems and low statistical power. No significant difference between the extended intervention and information was found at two- or six-months follow-up in the intention-to-treat analysis (Brendryen et al. 2017).

A Swedish study (n = 633), also described above (see chapter 4.6), compared brief intervention, extended intervention and assessment only. No significant differences were found between the groups in the main (intention-to-treat) analysis (Sinadinovic et al. 2014).

Seven of the studies (Postel et al. 2010; Riper et al. 2007; Blankers 2011; Hester et al. 2009; Brendryen et al. 2014; Cunningham 2012) showed internet alcohol programs to be significantly more effective in reducing alcohol consumption than briefer control intervention or waiting-list. But three large RCTs (Wallace et al. 2011; Sinadinovic et al. 2014; Cunningham et al. 2017) did not find a significant difference between an internet program and control.

4.7.3 Therapist guided internet programs

Guided extended interventions have been tested in five of the 14 previous controlled trials and have been shown to be more effective than waiting list (Postel et al. 2010; Blankers et al. 2011) and unguided controls (Sundström et al. 2016; Blankerset al. 2011). But the two most recent studies (Boß et al. 2018; Sundström et al. 2019) did not find differences between self-help and guided interventions. Below is a short description of the studies that have included a comparison of guided extended internet interventions.

A Dutch service, alcoholdebaas.nl, is a CBT-program that include e-mail contact with a therapist one to two times a week. The effects were tested in a randomized controlled trial, where the users of the intervention, offered access to the program for three months, were compared to a waiting-list control group. Results from the study showed that individuals allocated to the internet program decreased their alcohol consumption to much greater extent than those allocated to the control group (Postel et al. 2010).

A MI and CBT-based internet program, from the Dutch organization Jellineck, was tested in a RCT. Self-help was compared to the effects of therapist guidance, that included 40-minute synchronous chat sessions with a therapist, and to a waiting-list control group. At the three months follow-up, participants in both groups had reduced their weekly alcohol use significantly more than those in the waiting-list control group, but no differences were found between the intervention groups. At the six months follow-up, the therapist guided group was more effective than self-help in reducing weekly alcohol use (Blankers 2011).

A German extended internet Intervention with five modules including personalized normative feedback, Motivational Interviewing, goal setting, problem-solving and emotion regulation during five weeks. The intervention administered with or without adherence focused guidance, was compared with waitlist control in a RCT. All groups showed reductions of mean weekly alcohol consumption. There were no significant differences between the unguided and guided intervention. Participants in the combined intervention group reported significantly lower consumption than controls after six weeks. The intervention groups also

showed significant reductions in weekly alcohol consumption after six months and improvements regarding mental health outcomes after six weeks and six months (Boß et al. 2018).

As described above (see chapter 4.6) two Swedish studies have compared self-help and therapist guided internet programs. In a pilot study (n = 80) participants in the two guidance groups (asynchronous or synchronous) reported significantly lower past week alcohol consumption compared to the group without guidance; (mean difference 11.8 standard drinks, d = 0.77) (Sundström et al. 2016). In a later study (n = 166) analysis of six months follow-up data showed no significant differences in alcohol consumption between a high- and low-intensity intervention (Sundström et al. 2019). Where the high-intensity intervention included therapist guidance and the low-intensity did not.

4.7.4 Digital interventions in clinical settings

A few randomized controlled trials have been conducted in specialized clinical settings on digital (internet or computer-based) programs addressing alcohol use disorders. The first computer program that was tested in an outpatient setting was the Behavioural Self-control program for Windows, which in 1997 was shown to result in significant less weekly consumption at ten weeks follow-up compared to a waiting list (Hester and Delaney 1997).

A clinician-assisted computer-based CBT/MI program for alcohol and cannabis users with comorbid depression, was compared to regular CBT/MI treatment and to a brief intervention. Results indicated that the computer-based program was as effective as regular treatment at 12-month follow-up (Kay-Lambkin et al. 2009). A second study of the same program showed that the computer-based program was associated with a greater reduction in alcohol use compared to therapist-delivered treatment at three months follow-up. (Kay-Lambkin et al. 2011).

An internet CBT program was tested with clinical monitoring only, together with Treatment as usual (TAU) or as an alternative to TAU for alcohol use. Results showed greater increase in percent days abstinent for the combination of internet and TAU compared to TAU and to the internet program with monitoring (Kiluk et al. 2016).

An internet-based version of the Community Reinforcement Approach was tested in addition to regular care, among patients entering ten outpatient addiction treatment programs. Results showed that receiving the internet intervention reduced dropout and increased abstinence (Campbell et al. 2014).

A web-based CBT intervention has also showed a significantly greater decrease in binge drinking compared to TAU in a sample of veterans with symptomatic PTSD and substance use receiving treatment in primary care (Acosta et al. 2017).

Although these trials demonstrated effectiveness of digital alcohol programs, none of them have been non-inferiority or equivalence trials designed to show that the digital program actually is no less effective than face-to-face treatment. One non-inferiority study of a web-based intervention for alcohol has been conducted in primary care, with the proportion of hazardous drinkers in each group as primary outcome. The study failed to show non-inferiority for facilitated access to an internet self-help program compared to a face-to-face brief intervention at three- and twelve- months follow-up, when a biased outcome measure was removed from the analysis (Wallace et al. 2017).

4.7.5 Recent reviews of digital alcohol interventions

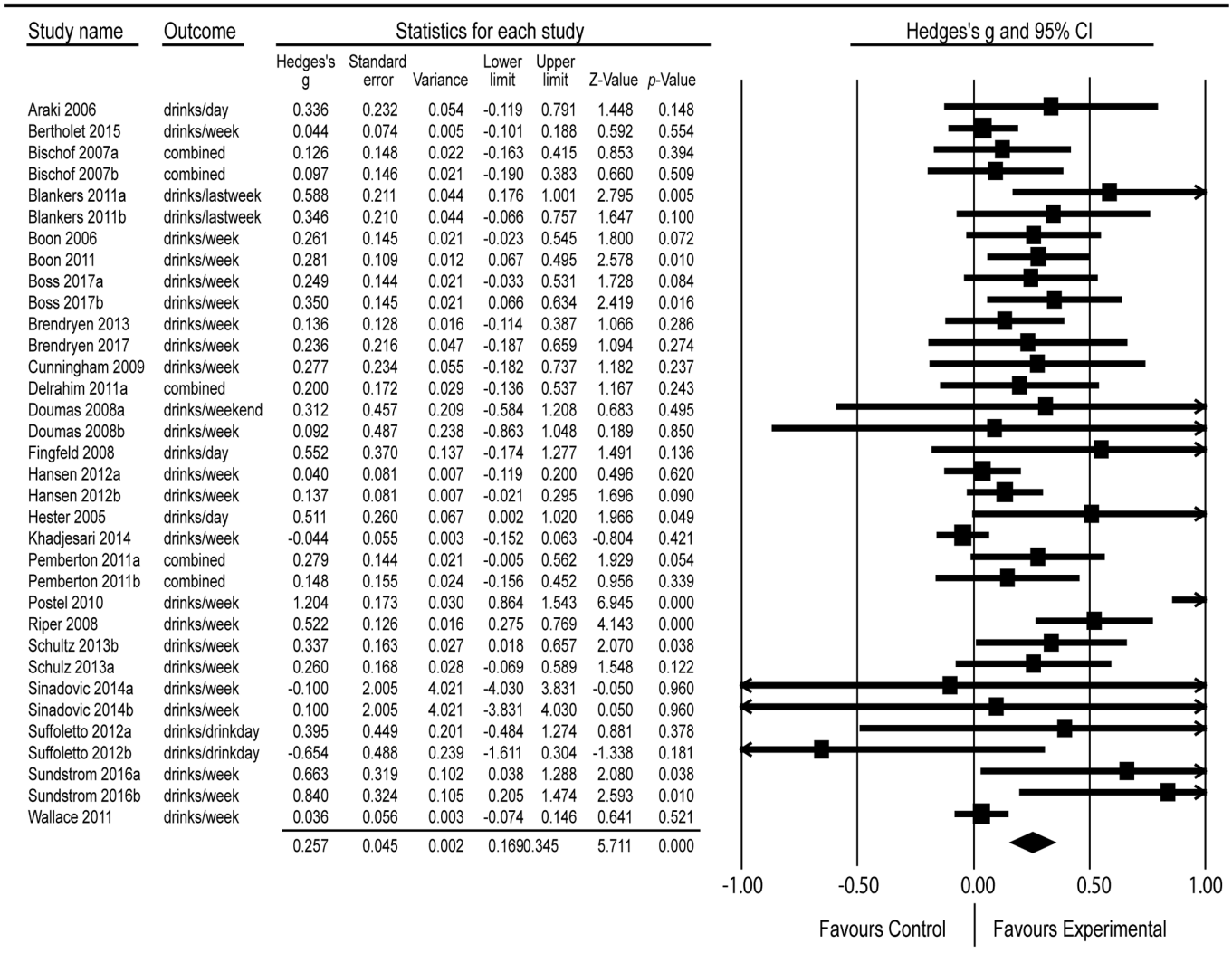
In a Cochrane review, participants who used digital interventions drank approximately 23 g (about two standard drinks) alcohol weekly (95% CI 15 to 30) less than participants who received no or minimal interventions at end of follow up. This evidence was of moderate quality from 41 studies with 19,241 participants. A smaller number of studies also showed one binge drinking session less per month and one unit per occasion less in the intervention group compared to no intervention controls (Kaner et al. 2017). The review found no difference in alcohol consumption when digital and face-to-face interventions were compared in five of the studies with 390 participants. The main sources of bias in the included studies were from attrition and participant blinding. No studies reported whether any adverse effects resulted from the interventions.

Together with several researchers in the field of digital alcohol interventions from different countries Riper conducted an individual patient data meta-analysis (IPDMA) of internet alcohol interventions, that included several of the extended interventions described earlier. An IPDMA boosts the number of participants studied and can increase the statistical power to evaluate the overall effects of a type of intervention. Individual data from 14,198 adult participants in 19 RCTs were pooled and analysed together. The mean age was 40.7 years, 47.6% were women, and the baseline mean weekly alcohol consumption was 38.1(SD = 26.9) standard units (10 g of alcohol). Post-intervention data were available for 8,095 participants. Compared with various controls, internet alcohol intervention participants showed a greater mean weekly decrease at follow-up of 5.02 (95% CI −7.57 to −2.48, $p < 0.001$) standard units (see figure 6) and a higher rate of treatment response (odds ratio 2.20, 95% CI 1.63–2.95, $p < 0.001$, number needed to treat = 4.15). Treatment response was defined as drinking less than 14/21 standard units for women/men weekly. Human-supported interventions were superior to fully automated ones on both outcome measures (difference: −6.78 standard units, p = 0.013; OR = 2.23, p = 0.009). A major limitation was high study dropout. The overall quality of the RCTs was rated as high (Riper et al. 2018).

The most recent review focused on CBT Tech (i.e. digital interventions based on CBT) found a small statistically significant effect ($g = 0.20$: 95% CI = 0.22 - 0.38) of digital intervention compared to minimal intervention control. When digital interventions were compared to treatment as usual (TAU) the difference was nonsignificant. But when digital interventions

added to TAU, was compared to TAU only, the effect size was positive and significant ($g = 0.30$). Of the identified studies, 60% explicitly targeted alcohol use moderation and 47% of programs combined elements of MI with CBT (Kiluk et al. 2019).

Figure 6. Forrest plot of conventional meta-analysis of internet alcohol interventions versus controls from Riper (2018)



4.7.6 Predictors and behaviour change techniques in internet alcohol interventions

Three studies have investigated predictors of outcome in internet alcohol interventions. In the first, female gender and a higher education level was found to predict positive outcomes (Riper et al. 2008). In the second one, high interpersonal sensitivity and having a shared living situation predicted positive outcome (Blankers et al. 2013). In one of the studies in his thesis, Sundström found that male gender, pre-intervention abstinence and two personality variables (a high degree of alexithymia and a low degree of antagonism) were predictive of low-risk drinking. He also found that treatment credibility predicted adherence to the internet program (Sundström 2017). Two studies have investigated predictors of retention, since attrition is a common problem in internet interventions (Eysenbach 2005). Higher treatment readiness, higher age, lower baseline consumption, female gender, having a university degree

and not having children have been shown to predict retention (Murray et al. 2013; Postel et al. 2011). A meta-analysis and meta-regression including 93 internet alcohol interventions (Black, Mullan, & Sharpe, 2016) coded for the use of 42 behavioural change techniques (BCTs) from an alcohol-specific taxonomy (Michie et al. 2012), use of theory and general characteristics. The analysis showed larger effects occurring in interventions with personal contact, normative information or feedback on performance, prompting commitment or goal review, the social norms approach and in samples with more women. The Cochrane review of internet alcohol interventions (Kaner et al. 2017), showed that a median of nine BCTs were used in the experimental arms of included 57 studies. The BCTs of behaviour substitution, problem solving and credible source were associated with reduced alcohol consumption (Garnett et al. 2018).

4.7.7 Coping Skills

One study investigated changes in coping skills before and after computerized CBT in outpatient treatment for substance dependence. Participants' responses in situations associated with high risk for drug and alcohol use were audio-taped and rated. They found statistically significant increases in the rated quality of coping responses for participants assigned to the computer intervention compared to TAU. The quality of coping responses also mediated the effect of treatment on abstinence during the follow-up period (Kiluk et al. 2010).

4.7.8 Promoting engagement

In a study of engagement promoting strategies used to increase the use of internet substance-use interventions; five different engagement promoting strategies were identified: tailoring, delivery strategies, incentives, reminders and social support. The most frequently reported strategies in 15 included studies was tailoring (47% of studies), followed by reminders and social support (40% of studies) and delivery strategies (33% of studies). A narrative synthesis indicated that tailoring, multimedia delivery of content and reminders are potential techniques for promoting engagement. The evidence for social support was inconclusive and negative for incentives (Milward et al. 2018).

4.7.9 The experience of users and therapists

The experiences of 18 users of the internet alcohol self-help program Down-your-drink have been investigated in a study. The results showed that the perceived privacy of the internet was important when the users searched for help and to avoid stigma and embarrassment (Khadjesari et al. 2015). During the development of the same intervention, early users expressed appreciation of the non-judgmental tone of texts and the self-help exercises, in written feedback (Linke et al. 2008). Interviews with 31 members of an online mutual aid group reveal that such groups are an alternative for people who experience barriers in accessing traditional treatment. The groups can be a place for individuals to explore their relationship with alcohol at early stages of change (Chambers et al. 2017).

In a systematic review on expectations and experiences regarding internet interventions outside of the alcohol field and with focus on women (Verhoeks et al. 2017), an overview of other common themes from previous research of users experiences is provided. The delay in time and absence of non-verbal information can disrupt communication in internet interventions and make it feel less empathic. Texting might make it more difficult for users to explain complex situations and feelings and lead to misunderstandings. The relationship with an online therapist is viewed as important and sometimes experienced as just as close as in face-to-face treatment. The personal responsibility and autonomy that come with this flexibility of internet interventions are appreciated by the users, give them a sense of autonomy and a feeling of being empowered. But internet interventions can also require more self-discipline and motivation from the users, e.g. so they do not skip parts of the program (Verhoeks et al. 2017).

The level of contact and level of independence is described as important factors in computerized therapy in a meta-synthesis of the users' experiences (Knowles et al. 2014). Some patients are unable or unwilling to accept internet interventions without personal contact and feel alone, while others appreciate the enhanced anonymity and flexibility of the treatment and feel secure, with the majority of patients being ambivalent (Holst et al. 2017). In interviews with both clients and therapists a unique use of time was described with the asynchronous therapist-contact in internet interventions and "time to think" was a theme that differentiated it from traditional treatment (Dunn 2012).

4.7.10 Alliance in internet interventions

According to several researchers the working alliance can be as strong and have similar impact on outcomes in internet interventions as in face-to-face, even though the format is very different (Cavanagh and Millings 2013; Berger 2017b; Pihlaja et al. 2018). According to therapists working via internet, anonymity and the way of communicating affect the development of trust important for the working alliance (Fletcher-Tomenius and Vossler 2009). In a recent study with CBT therapist working online and face-to-face, they expressed that working alliance may be achieved faster and more easily face-to-face (Bengtsson, Nordin, and Carlbring 2015). It can be more difficult for users to explain complex situations or feelings in text messages and lead to misunderstandings. According to the review by Berger (2017) future studies should try to identify unique characteristics of the therapeutic alliance in different treatment formats (Berger 2017).

5 Aims

The overarching aim of this thesis was to study if internet alcohol programs are an effective treatment option for people with alcohol use disorder. One observational study and two randomised controlled studies of internet alcohol programs, as well as a focus group study with therapist have been conducted (see figure 7). The aim of each study is listed below:

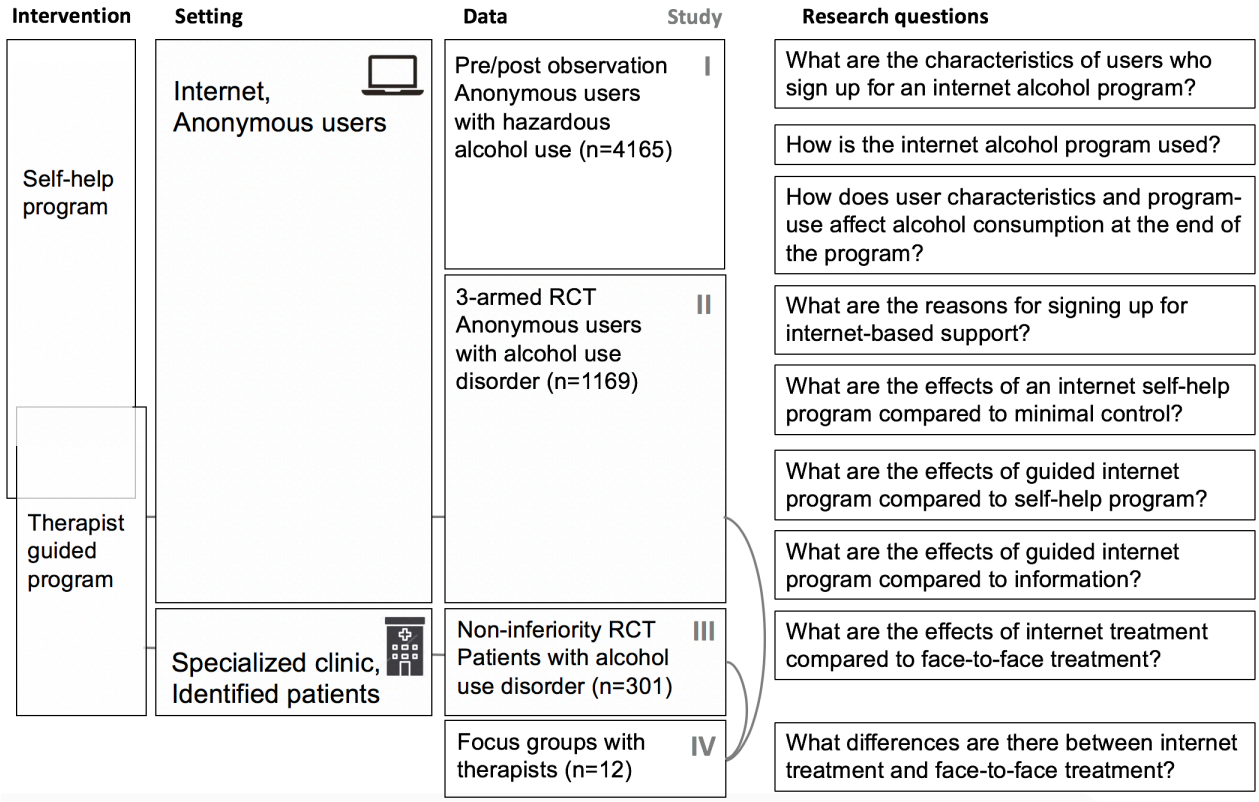
I. The aim of this naturalistic study was to investigate who was using an internet alcohol program, how it was used and the relationship between use characteristics, usage of the internet alcohol program and the outcome in alcohol consumption.

II. The aim of this randomized controlled trial was to evaluate the effects of an internet alcohol program with or without therapist guidance on alcohol consumption and alcohol-related problems in anonymous users with likely alcohol dependence.

III. The aim of this randomized controlled trial was to evaluate if an internet-delivered cognitive-behavioural therapy was non-inferior to face-to-face cognitive-behavioural therapy in reducing alcohol consumption and alcohol-related problems among adult users with Alcohol Use Disorder at a specialized clinic.

IV. The aim of this focus group study on the therapist perspective was to understand differences between internet and face-to-face settings in the treatment of problematic use of alcohol, problematic use of cannabis or family members of people with problematic alcohol use.

Figure 7. Overview of studies in the thesis



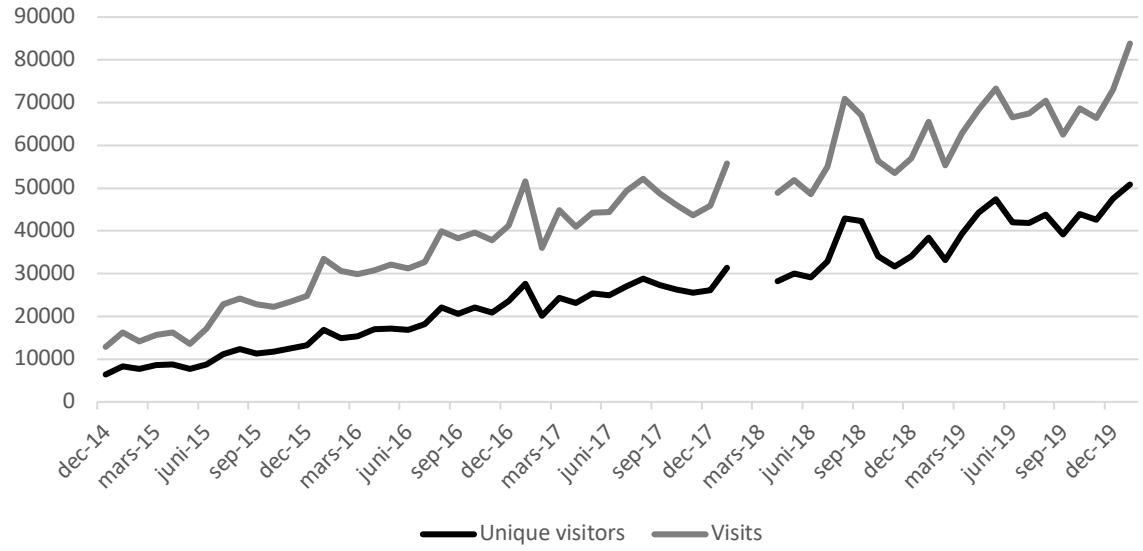
6 Empirical studies

Four studies are included in this thesis. The studies cover different aspects of internet alcohol programs.

6.1 Alkoholhjälpen

A common denominator in the studies in this thesis is Alkoholhjälpen (https://alkoholhjalpen.se), where the participants in Study I have been recruited, where Study II have been conducted, where the internet-delivered program in Study II and III originate from and where some of the therapist in Study IV worked. Alkoholhjälpen is an web site that provides information and a discussion forum for individuals seeking help for their alcohol consumption. The site was owned by the Swedish Public Health Agency until 2015 when it was transferred to the Stockholm Centre for Dependency Disorders and has government funding. The site has been publicly accessible since 2007. During the recruitment period for Study II, Alkoholhjälpen had approximately 20 000 unique visitors every month and a mean of 100 new forum-posts every day (see figure 8 for development over time). All service use is free of charge and no advertising is allowed on the website. Communication between the server hosting the site and the users is encrypted and protected with an individual login name and a password.

Figure 8. Monthly visits and unique visitors at Alkoholhjälpen during the last 5 years



6.2 Internet Cognitive Behavioural Therapy programs

The internet interventions studied in this thesis were delivered via the open-source platform Drupal (drupal.org) configured by Magnus Johansson. Communication between the program server and the user was encrypted and protected with an individual login name and a password. Two internet Cognitive Behavioural Therapy (ICBT) programs, eChange and the

Alkoholhjälpen program, were used in Study I-III and are described below. The therapists in Study IV have also used other ICBT programs that are described elsewhere (Sundström et al. 2019; EÉk et al. 2020; Sinadinovic et al. 2019).

6.2.1 eChange (Study I)

The program is a Swedish translation and adaptation of the Dutch program Therapy Alcohol Online (Blankerset al. 2011) which, in turn, is based on a Dutch adaptation of the Cognitive Behavioural Therapy (CBT) and Motivational Interviewing (MI) manuals from project MATCH (W. R. Miller 1995; R. Kadden 1995). The program consists of eight modules with two to three pages of reading material per module along with interactive exercises where the participant can write answers to open-ended questions or choose from pre-formulated options (see list of modules in Table 5). The first four modules are released to the user consecutively, once a week; modules five to seven are simultaneously released during the fifth week for use during weeks five and six, and module 8 is released at week 7. Then, there is a three-week gap between weeks seven and ten to give the participant an opportunity to try out the techniques taught in the program. Each participant receives an e-mail every time a new module is accessible. During the intervention period, all participants are encouraged to register craving as well as daily alcohol consumption in a calendar included in the program. Users can access continual feedback about their progress through the calendar's statistics page, where they can see their average personal consumption as well as the number of days drinking, the number of non-drinking days, and binge drinking occasions. In addition, they can view a personal summary of their own risk situations with information on where they drank and the level of craving they had experienced on each risk situation occasion. An electronic personal diary is also available for the participants.

6.2.2 Alkoholhjälpen program (studies II and III)

The program is based on self-help material used in previous studies, both on the internet and in specialist care (M. Johansson et al. 2017; Sundström et al. 2016; Wallhed Finn et al. 2018; Sinadinovic et al. 2014). Content and exercises in the program are based on MI, Relapse Prevention and Behavioural Self Control Training. The program is divided into five main modules, three extra problem-solving modules and ten fact sheets (see list of modules in Table 5). The length of the program is equivalent to fifty pages of printed text. See Figure 9 for screenshot of the program. Users are also encouraged to register alcohol-consumption or craving, and details on the situation where they drank or experienced craving. This is done in a drinking-calendar included in the program which can be used daily or for a whole week. Continual feedback about progress is given to the user through the statistics page as in eChange (described above).

Tabell 5. Content in the two ICBT programs

eChange	**Alkoholhjälpen**
1. Analysing advantages and disadvantages of drinking (decisional balance)	1. Motivation (including brief feedback on assessment)
2. Setting an alcohol consumption goal (moderation or abstaining from drinking)	2. Drinking-goal and Self-control skills
3. Learning self-control skills	2.1 Blood Alcohol Concentration
4. Identifying risk situations	3. Behavioural analysis of drinking and risk-situations
	4. General problem-solving
5. Managing craving	4.1 Handling cravings
6. Handling emotions	4.2 Handling feelings
7. Dealing with social pressure	4.3 Drink-refusal skills
8. Developing a crisis plan	5. Preventing relapse
Drinking calendar per day Personal Diary	Drinking calendar per day or week

Figure 9. Pictures of program module on a computer and the drinking-calendar on a smartphone

6.3 Measures

Here the measures used in Study I-III are presented. Primary outcomes are presented in more detail than secondary.

6.3.1 Alcohol consumption

To record the number of standard drinks of alcohol consumed each day during the past seven days, the Timeline Follow Back (TLFB) (L. Sobell and Sobell 1992) was used. When administered via computer TLFB has been found to yield data that correlate with administration via paper and pencil (L. C. Sobell et al. 1996). The TLFB has been shown to be a valid and reliable procedure to document recent drinking also when administered via internet (Rueger et al. 2012) and in a seven-day version (Thomas and McCambridge 2008). One standard drink is equal to twelve grams of alcohol according to the Swedish definition. Number of non-drinking days, number of binge-drinking days (defined as days with three or more drinks for women and four or more drinks for men), the average number of drinks on drinking days and low-risk consumption (according to Swedish guidelines 14 or more drinks per week for men, nine or more drinks per week for women and no binge drinking) during the week were calculated from the TLFB score.

6.3.2 Alcohol use disorder

The Alcohol Use Disorders Identification Test (AUDIT) is a well-established and widely used ten-item instrument for measuring alcohol use, including alcohol consumption and signs of harm or dependence related to alcohol consumption (J. B. Saunders, Aasland, Babor, et al. 1993). The Internet version has shown Cronbach's α values of 0.80–0.93 (Sinadinovic, Wennberg, and Berman 2011) and the Swedish paper version has yielded Cronbach's α values of 0.81–0.82 (Bergman et al. 2002). Problematic alcohol use was assessed with both the total *AUDIT-score* and categorized in the use-categories: I: 0-6p, II: 7-15p, III: 16-19p and IV: 20-40p. The sum of the three first items (*AUDIT-C*) was also used to assess alcohol consumption (Vitesnikova et al. 2014). For this thesis Reliable change (improvement) was calculated for Study I-III using the reliable change index (Jacobson and Truax 1991) a reduction of at least six points on the AUDIT. Alcohol use disorder and alcohol dependence criteria was assessed by the self-rated number criteria during the last year according to *DSM-5* (American Psychiatric Association 2013) and *ICD-10* (World Health Organisation 1992). At three- and six-months follow-ups the timeframe for AUDIT, ICD-10 and DSM-5 was changed from twelve months to three months.

6.3.3 Anxiety and depression

The Hospital Anxiety and Depression Scale (*HADS*) that has 14 items on two subscales to measure *anxiety and depression* symptoms (Zigmond and Snaith 1983; Bjelland et al. 2002) was used in Study I. In Study II-III symptoms of depression were measured by Montgomery Asberg Depression Rating Scale – Self Rated (*MADRS-S*) (Svanborg and Åsberg 2001; Holländare, Andersson, and Engström 2010) and symptoms of anxiety were measured by the

Generalized Anxiety Disorder Assessment–7 Items (*GAD-7*) (Spitzer et al. 2006; Dear et al. 2011).

6.3.4 Health and quality of life

EuroQol-5 dimension (*EQ-5D*) assesses health-related quality of life and consists of five items covering the dimensions of mobility, self-care, usual activity, pain/discomfort, and anxiety/discomfort. From the five items, an index score was calculated with Crosswalk value sets, using the United Kingdom as a reference (Van Hout et al. 2012). The EQ-5D also includes a visual analogue scale (VAS) between 0 and 100 regarding the respondent's current health status (Herdman et al. 2011). In the first study we also used The World Health Organization Quality of Life Scale-abbreviated version (*WHOQOL*), which has 26 items and measures quality of life on four domains: physical, psychological, social, and environmental (Skevington, Lotfy, and O'Connell 2004).

6.3.5 Readiness and motivation

Readiness to change was measured with a VAS, where users responded on a scale of 0-10 to the statements "I am not ready to reduce/quit my drinking." (0) and "I am very much ready to reduce/quit my drinking" (Bertholet et al. 2009). The Readiness to Change Questionnaire (*RCQ*) assesses the respondent's motivation for change in Study I. The RCQ has twelve questions covering the pre-contemplation, contemplation, and action dimensions of the Trans-Theoretical model of change (Forsberg, Halldin, and Wennberg 2003; Rollnick et al. 1992).

6.3.6 Alliance

The Session Rating Scale (SRS) (A. Campbell and Hemsley 2009) consists of four visual analogue scales corresponding to Bordin's definition of the therapeutic alliance (Bordin 1979). For the studies in this thesis the SRS was adapted for use with internet interventions. In Study III the 12-item Working Alliance Inventory (Munder et al. 2010) was also used for measuring working alliance between patient and therapist.

6.3.7 Other measures

Use of *other support* was assessed by four questions covering who and where participants talked to someone about their alcohol problems, and which medication or which other internet resources they had used in order to change their alcohol consumption. In Study III, Carbohydrate-deficient transferrin (*CDT*) which is an alcohol specific biomarker, was used (Helander, Péter, and Zheng 2012). Elevated level of CDT is an indicator of regular excessive alcohol use during the last weeks. All use of the internet intervention was logged for each user. Participants that completed five or more modules of the program in Study I were regarded as completers. In Study II-III that number was lowered to 4, since the goalsetting and self-control module were combined in one module.

6.4 Recruitment procedure on the internet

In Study I-III recruitment was conducted on the web. Interested individuals started by completing an automatic screening and online consent to participate. Eligible participants then had to create a personal account with a username and password for secure access to the online-questioners and intervention. Contact data in the form of an e-mail address and phone number was collected. Email and phone numbers were not verified and not used for identification or for any other purposes than reminders from the intervention and at follow-ups. Registrants that did not meet inclusion criteria were informed that they did not qualify for the study and were invited to use the open parts of the website, a help-line or regular service at a clinic. To be able to complete the registration the participant needed to understand written Swedish and be computer literate enough to access and navigate the website via a computer, tablet or smartphone. Before registering, potential participants were also informed that the interventions were not intended for users who were experiencing withdrawal symptoms, psychosis, schizophrenia, bi-polar disorder or suicidal thoughts. After the personal account was created, the participant was asked to fill out baseline measures before getting randomized and getting access to the interventions.

6.5 Study I

6.5.1 Background

Following a pilot randomised controlled trail (RCT) of eChange (Sundström et al 2016) that was not a part of the current thesis, this naturalistic observational study, was conducted. The study provided knowledge about members of the general public that find and choose to participate in internet alcohol programs and how the intervention is used. There is a lack of information in previous research on possible dose-response relationships or the possible importance of receiving other care. Results regarding which populations that are more or less likely to benefit from internet interventions are inconclusive in previous research. Earlier Swedish RCTs that we had conducted did not have enough participants in the intervention arms to allow for analysis of different subgroups users. Prior to conducting a full scale RCT, we also wanted to see if it was feasible to conduct a large trial alongside Alkoholhjälpen and test the platform for collecting data and deliver intervention.

6.5.2 Method

This study used a pre-post observational design where all included participants received access to the intervention. Participants who were interested in receiving internet support were recruited through Alkoholhjälpen, and sent to a separate study-site, eChange. Adults with an AUDIT-score indicating at least hazardous use, i.e., a score of ≥6 for women and ≥8 for men where included and after baseline assessment got immediate access to the internet program eChange as a self-help. Two primary outcomes were used in the study. The first was Low-risk consumption of alcohol. The second was a change in the level of alcohol use that was seen as clinically relevant, here defined as moving from one alcohol use category in AUDIT at baseline to another category at follow-up. Secondary outcomes included: AUDIT-C, HADS, EQ-

5D, WHOQOL, RCQ, Readiness to change alcohol consumption and use of other support. Participants were also encouraged to rate the working alliance with the program via SRS after completing each module in the program. Because module completion rates were low, a change was made during the study so that users could access any of the modules at any time. Follow-up was conducted ten weeks post-registration. In order to evaluate predictors of changed drinking behaviour at follow-up, two multiple logistic regressions were conducted with primary outcomes as dependent variables.

6.5.3 Results

From January 2013 to January 2015, 7009 screening forms were completed and 3897 participants were included who accessed the internet self-help program. Registered participants had a mean age of 42 years (SD = 12) and 52% were women. Of those that signed up for the internet program 82% had a level of alcohol use corresponding to harmful use or alcohol dependence and 51% had a clinical level of anxiety symptoms. Program use was low, with a mean of 2.2 (SD = 2.2) modules completed. A significantly smaller proportion (13 vs 16%, $\chi 2=11.863$, $p = 0.001$) completed the program among the participants who were given access to all modules at once compared to the initial participants who were allocated one module per week. The attrition rate at follow-up was high (73%). Among participants in the follow-up, 40% reported low-risk consumption (see details in table 7). Significant decrease in alcohol consumption and improvement in most other outcome measures occurred between baseline and follow-up. The within group effect size for change in standard drinks consumed in the past week was d = 0.74; and for change in AUDIT d = 0.98. The regression model for low-risk drinking revealed the following odds ratios: women (odds ratio (OR) = 0.63), diary-users (OR = 0.70) people with more drinking days (OR = 0.90) more binge-drinking (OR = 0.78) or other drug use (OR = 0.90) at baseline were less likely to have low risk consumption at follow-up; whereas people who received all modules at once (OR = 1.46), completed the program (OR = 1.47), spoke with someone about their drinking since registering for participation in the study (OR = 1.32) had higher depression score (OR = 1.04) and had a higher readiness to change alcohol consumption (OR = 1.15) were also associated with an increased likelihood of low-risk consumption at follow-up.

6.6 Study II

6.6.1 Background

In this study we compared the effect of different forms of internet-delivered support at Alkoholhjälpen. Several previous studies have compared self-help internet interventions to interventions with less intensity, like brief intervention, information or waiting lists. In this study all the participants were offered interventions aimed at helping them reduce their alcohol consumption and alcohol related problems. The study was one of the larger controlled trials to investigate the added value of having an online therapist.

6.6.2 Method

Included participants were adult help-seekers at Alkoholhjälpen with likely alcohol dependence (≥3 ICD-10 criteria or >15 points on AUDIT). They all got access to the active discussion forum as well as information about alcohol and health. In a three-armed randomized controlled trial they were randomly assigned to also receive (1) an ICBT program as self-help without therapist guidance, (2) the same program with therapist guidance or (3) to text-only information on changing alcohol habits. Participants were blinded to what intervention that was offered to other participants. After signing-up and completing baseline questionnaires all participants completed a survey on why they choose to use an internet intervention and their preferences regarding such support. Directly following the survey and randomization, the groups were given access to the assigned intervention. Automatic reminders with suggestions on what module to work on were sent once a week for four weeks and after six and eight weeks. In addition to the program the therapist-guided group could communicate with a therapist during the twelve weeks of the program. The therapist messages focused on motivating the user to continue using the program and change their alcohol consumption. After a participant completed a module, the therapist wrote personal feedback to the user. Users that did not use or stopped using the program were reminded by the therapist. The primary outcome was the number of standard drinks in the preceding week. Secondary outcomes included AUDIT, ICD-10, DSM-5, readiness to change alcohol consumption, use of other support, EQ-5D, MADRS-S and GAD-7. Follow-up was conducted three- and six-months after recruitment. Working alliance was measured twice during the program. The study was powered to detect small differences in effect between the interventions. Differences in observed means at each follow-up were analysed with t-tests, under the missing at random assumption. This was supplemented with mixed effects modelling to better handle data from repeated observations, non-normal distribution of outcomes, and missing data.

6.6.3 Results

From March 2015 to March 2017, 1406 persons were screened and 1169 participants, with a mean age of 45 years (SD = 13) and 56% women, were randomized. In the therapist-guided group 40% were program completers and in the self-help group 30% (Chi^2=6.46, p = 0.011). The most endorsed reasons for using internet support were '*Anonymity*' and '*Access to intervention at any time*'. The most endorsed features were '*Assessment feedback*' and '*Online contact with a therapist*' (detailed results from the survey are presented in table 6). At three months after inclusion the therapist-guided group had significantly lower mean weekly alcohol consumption compared to the control group (difference=-3.84, 95 CI=-6.53 to -1.16), but no significant differences in weekly alcohol consumption was found between the self-help and information or therapist-guided and self-help groups. Significant differences between the therapist-guided group and the information group were also found in the secondary outcomes: AUDIT-score, AUDIT-C, DSM-5, ICD-10. A difference between the self-help group and information group was found on the AUDIT-score at three months, favouring the self-help group. At six months no significant differences in weekly alcohol consumption or in secondary outcomes were found between any of the three groups. The mixed model analysis

revealed a larger reduction in weekly alcohol consumption over time in the therapist group (time * therapist: t=-2.33, p = 0.02) compared to the information group. No effect of self-help * time was found compared to the information group. There was a significant decrease in weekly alcohol consumption over time for participants in all three groups. The proportions of participants with low risk alcohol consumption and reliable change in the AUDIT-score at three months follow-up is reported in table 7 and figure 9.

Table 6. Reasons for choosing internet intervention and preferences regarding it

		Mean	SD	Important (>7)
Reasons	Access at any time	7.93	2.42	68%
	Anonymity possible	7.8	3.02	67%
	Not have to travel	7.33	3.00	59%
	Alcohol use not in patient record	6.61	3.81	55%
	Decide your own goal	7.22	2.83	54%
	Not have to tell people close to you	6.55	3.43	50%
	Not having to visit a clinic	6.14	3.50	45%
Content	Relapse-prevention	8.89	1.70	87%
	Motivation to change	8.66	1.83	81%
	Handle cravings	8.59	2.13	81%
	Planning not to drink	8.54	2.01	81%
	Goal-setting	8.02	2.19	69%
	Emotional problems	7.7	2.57	64%
	Drink-refusal	6.91	3.19	52%
	Facts on alcohol and health	6.75	3.06	52%
	Problem-solving	6.77	2.99	50%
	Relationship problems	6.11	3.41	44%
Functionality	Assessment with individual feedback	7.73	2.19	63%
	Contact with therapist over internet	7.41	2.40	57%
	Content customized to you based on answers	7.45	2.21	57%
	Weekly registration of progress	7.29	2.32	56%
	Your written or registered information is saved	7.03	2.78	55%
	Mobile ready	6.55	3.42	53%
	Reminders via email	6.8	2.94	51%
	Refences to scientific sources	6.8	2.92	50%
	Encouragement or visual reinforcement	6.15	3.00	39%
	Discuss with other users	6.07	3.06	39%
	Mobile app downloadable	5.67	3.42	39%
	Share with face-to-face therapist	5.6	3.38	36%
	Daily registration of progress	5.67	3.00	33%
	Compere your problems to others	5.05	3.28	28%
	Multimedia content	3.26	2.95	10%

6.7 Study III

6.7.1 Background

Previous meta-analyses have indicated that internet interventions may have similar effects as face-to-face interventions. Only a few studies of internet alcohol programs have been conducted in specialized care. No previous studies in the field of alcohol use disorder have compared the same program content delivered via internet or face-to-face. With this study an internet alcohol program was implemented at a Swedish outpatient clinic for alcohol use disorder for the first time.

6.7.2 Method

Visitors to the website of Riddargatan 1, an outpatient clinic within the Stockholm Centre for Dependence Disorders, specializing in treating alcohol use disorder, were invited to participate in a study on both internet-based and clinic-based services. After online automated screening, adults with likely alcohol dependence (≥3 ICD-10 criteria or >15 points on AUDIT) were contacted via phone by a research nurse who booked them for assessment with a physician at the clinic. Individuals with alcohol use disorder and without severe comorbidity or need for treatment of withdrawal were randomized to receive five modules of ICBT or five sessions of face-to-face CBT delivered during twelve weeks. The same program and the same therapists were used in both treatment arms. The ICBT-program was the same as in Study II. The program content was covered in the sessions with the face-to-face patients and provided as a paper printout. After three and six weeks into treatment WAI and SRS was assessed. The primary outcome was the difference between groups in alcohol consumption, in number of standard drinks during the previous week, at six months follow-up. Number of non-drinking days, binge-drinking, AUDIT, DSM-5, EQ-5D, readiness to change alcohol consumption, MADRS-S and GAD-7 were assessed online at baseline and three- and six-months after recruitment. The analysis of outcome was performed using generalized linear models with the analysis based on intention-to-treat and missing data handled with multiple imputation. Sensitivity analysis was performed according to per protocol and missing not at random.

6.7.3 Results

From December 2015 to December 2017, 735 screenings were completed and 301 participants, with a mean age of 49 years (SD = 12) and 38% women, were randomized. Controlling for baseline consumption, the difference between internet and face-to-face group was non-inferior according to the prespecified limit of five standard drinks of alcohol the previous week at six-month follow up (12.3 vs 11.4, diff=0.9, 95 CI -1.1-2.9) and at three months follow-up (12.0 vs 9.7, diff 2.3, 95 CI -0.2-4.7). In the per-protocol sensitivity analysis the results did not show non-inferiority at three months (13.2 vs 9.5, diff=3.7, 95 CI= 0.6-6.8) but non-inferiority at six months (13.0 vs 11.4, diff=1.6, 95 CI=-1.0-4.2). At six months internet treatment was inferior to face-to-face treatment, according to the limit of d = 0.32, in all secondary outcomes with the exception of AUDIT-score and number of binge drinking days.

Proportion of participants with low risk alcohol consumption and reliable change on AUDIT at three months is reported in table 7 and figure 9. Participants who completed the alliance rating during treatment gave a significantly higher rating of the working alliance in the face-to-face group compared to the internet group. A higher proportion of participants in the Internet group missed other forms of contact compared to participants in the face to face group. The internet group also experienced the treatment as less personal.

6.8 Study IV

6.8.1 Background

There are very few descriptions of the therapist experience of internet treatment of alcohol or other substances. To my knowledge, no previous study has investigated how therapists experience working with internet alcohol treatment. This kind of information can help us better understand the results from the controlled trial.

6.8.2 Method

Therapists working with substance use disorders, both online and face-to-face, were interviewed in three focus groups by an experienced qualitative researcher. The perspectives of the therapists were analysed with content analysis.

6.8.3 Results

Five major themes were identified in the analysis: Communication, Anonymity, Time, Presence and Focus. Internet treatment is very much text-based, and to communicate in writing differs from talking. It suits some therapists and some patients more than others. The therapists cannot see or use body language and facial expressions. This can create an uncertainty. The anonymity of the internet can increase self-disclosure and disinhibition and is seen as a method to reach and motivate people in need of support. Technology forms the communication in internet treatment. There is less immediate response but increased time for reflection and repetition. It can make the treatment "flat" or create a feeling of "muteness". Therapists say they take up less space in internet treatment and are at the same time more available, which can create more autonomy for the patient. Internet-delivered programs increase focus on the treatment content rather than other problems of the patient. Small talk and the physical body might disturb focus in face-to-face. Some differences can make the therapist's work easier and more pleasant.

Figure 10. Venn diagram showing proportion of participants in Study I-III with low-risk consumption (white), reliable change in AUDIT (blue) or change to lower AUDIT category (red) among all participants (dark green) at first follow-up.

Table 7. Proportion of participants in Study I-III with low-risk consumption, reliable change and change in audit category among all participants at first follow-up (n = 3490).

	Study I		**Study II**		**Study III**		**Total**	
Low risk alcohol consumption	384	39.7%	236	41.6%	103	50.7%	723	41.6%
Change in AUDIT category	501	49.7%	378	66.7%	164	80.8%	1043	58.6%
Reliable change in AUDIT	443	43.9%	336	59.3%	147	72.4%	926	52.1%

6.9 Additional analysis

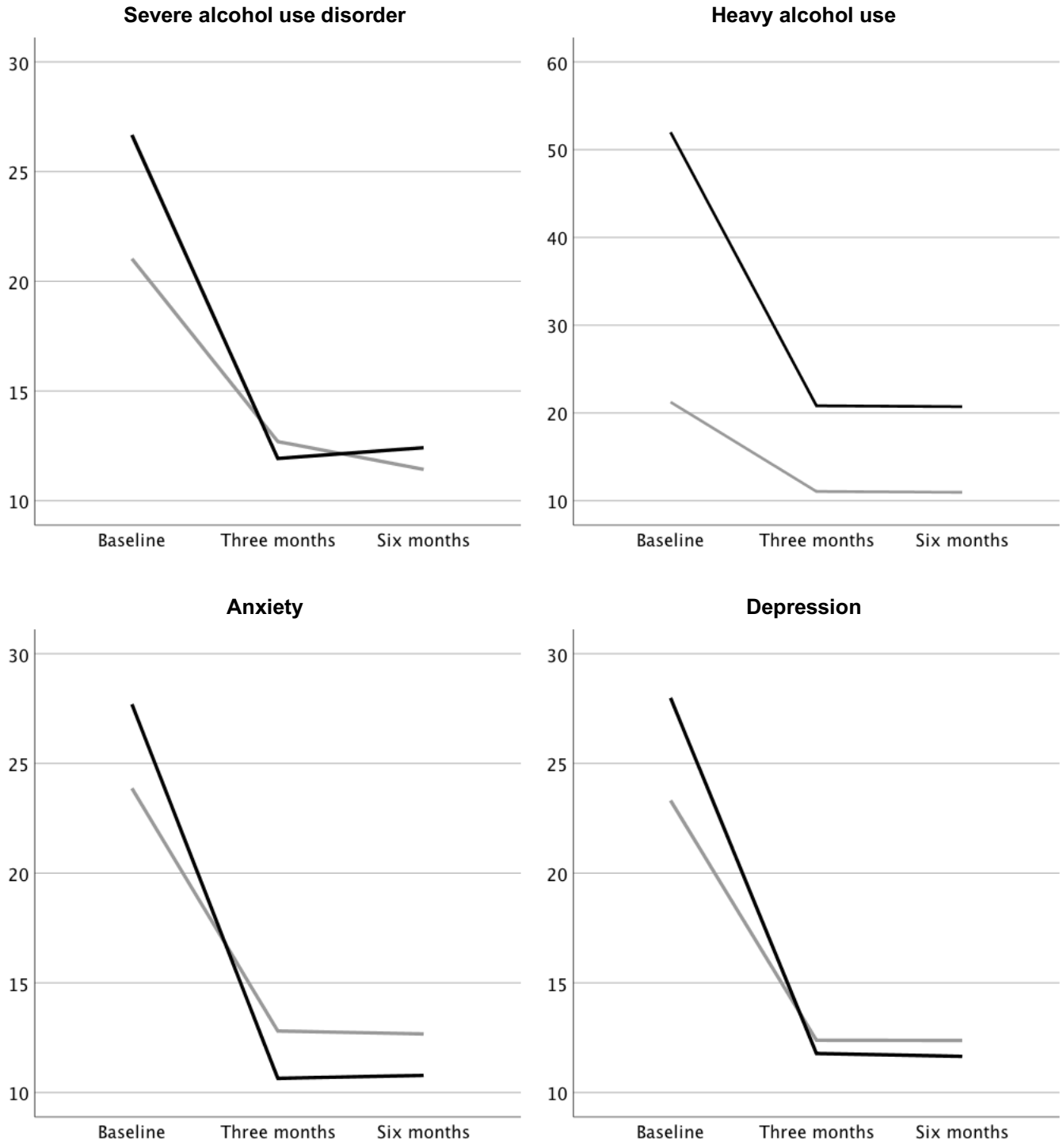
Exploratory analysis of factors that might affect drinking outcomes were conducted on pooled data from Study II and III (see figure 11). Estimates at each follow-up where adjusted for base-line alcohol consumption.

The analysis did not show any significant differences in alcohol consumption at follow-ups among participants with heavy alcohol use (n = 551 (19.4%), on average >50g/day for women or >80g/day for men) compared to other participants. Participants with severe alcohol use disorder (n = 812 (28.3%), >5 DSM-5 criteria) had significantly lower alcohol consumption compared to other participants at three months but with no significant difference at six months.

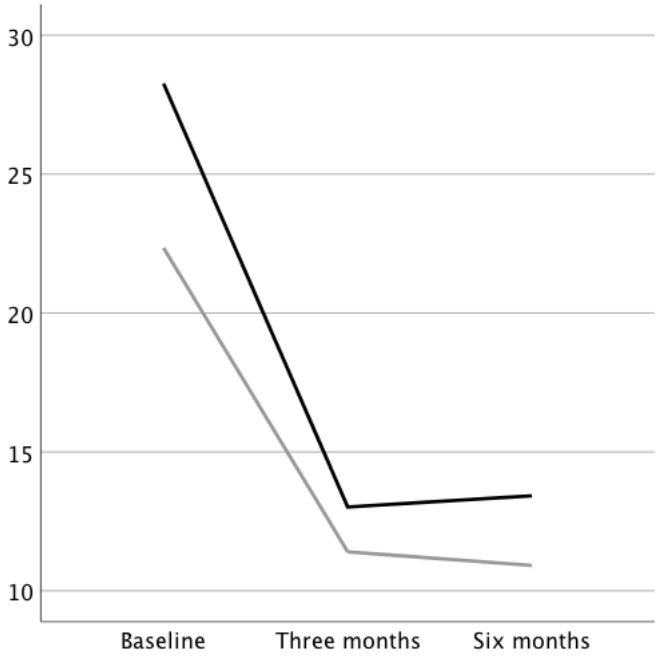
Having comorbid psychiatric problem in the form of clinical level symptoms of anxiety (n = 905 (31.8%), GAD-7>10) or depression (n = 1093 (38.4%), MADRS-S>20) at baseline was not associated with lower alcohol consumption at follow-ups. Women had significantly lower consumption than men at six months, but with no significant difference compered to men at three months follow-up.

Among those randomized to an internet program, completers (n = 696 (27.1%), < 4 modules) had reduced alcohol consumption significant more compered to non-completers at three months follow-up, but with no difference at six months. Participants in the internet programs who initially chose a non-drinking goal (n = 433 (24.8%)) had significantly lower alcohol consumption compered to participants with a moderation goal and participants that did not set any goal at both follow-ups. Those who rated the alliance during the program as high also reported significantly lower alcohol consumption compared to those who rated the alliance as low.

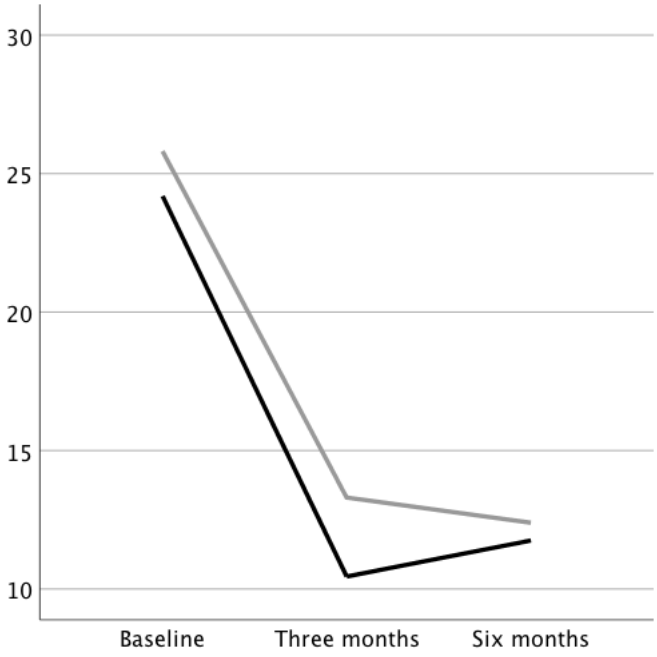
Figure 11. Change in weekly alcohol consumption over time in different groups of participants in Study II and III



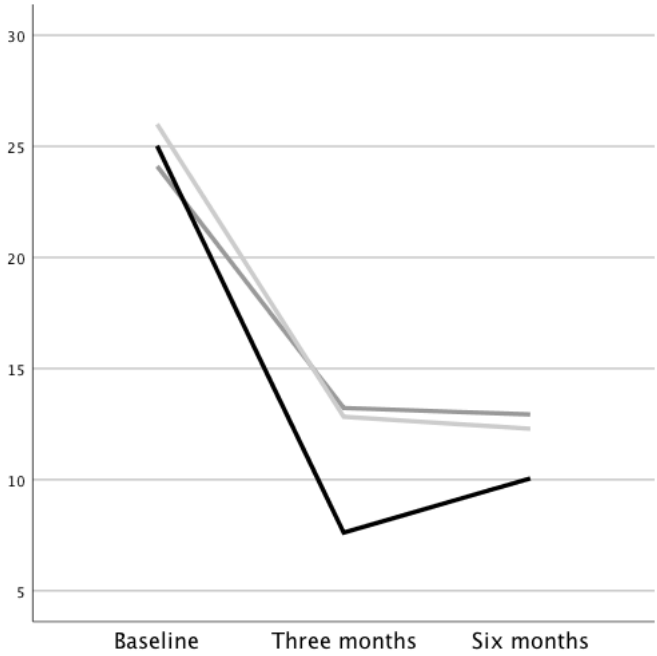
Male



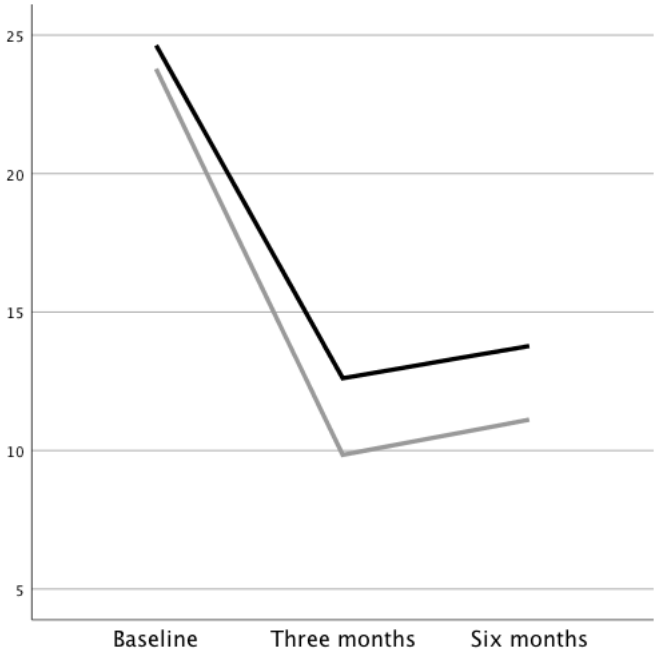
Program completers



Non-drinking goal



Low alliance



6.10 Ethical aspects

One of the most important ethical aspects that pertains to all research on Internet-based interventions is that study participants need to be sure that no unauthorized individuals is able to access the information they provide via the Internet. To avoid the risk of data breach, the transfer between computers and the server where the intervention is located were encrypted. In addition, access to the database (where all data was stored) required both a password and a special encrypted key that was only available on two computers. Only two people in the research group had access to the database. Upon completion of data collection, personal information that enables identification of study participants will be deleted from the database. Participants were asked about alcohol use, drug use and mental health. Such questions can be perceived as sensitive and intrusive. Therefore, we informed participants that all questions are asked to all participants. The study participants were also informed that they, at any time and without explanation, can withdraw participation in the study without affecting their ability to receive other support or treatment. Another aspect is individuals with problems that require more treatment or support than can be offered through internet intervention. For example, risk of severe withdrawal or serious mental illness. Individuals who reported symptoms of such conditions during recruitment were informed that the intervention is not intended to help individuals with such symptoms and these are recommended to seek help in traditional addiction care or psychiatric care instead.

Another important ethical issue concerned participants who were randomized to the control group. These participants had an identified alcohol use disorder, but as a result of randomization to the control group, were not offered the same help as the others to reduce or stop their consumption. On the other hand, research on the effects of Internet interventions for problematic alcohol use have shown that information about the harmful effects of alcohol, having access to an online forum as well as the participation in a study in-itself, often have positive effects on drinking. Participants randomized to the control group have the same opportunity to seek usual care or treatment for their problems as participants randomized to the intervention group have. If we consider that someone's initial alcohol use is so severe that it should not wait to receive help, they were provided with information on where they could find professional help. A final dilemma in the controlled studies concerns research participants who, at the end of the study, had a remaining serious problem regarding alcohol consumption, mental illness or health. Study participants with such conditions were, in a supportive way, recommended to seek help in specialized care.

In Study IV the material was free from sensitive material and did not need to undergo ethical approval according to Swedish law. The participating therapists were informed of the study's purpose and methods, and that their participation would be anonymous and voluntary. To protect their identities, some details of their stories were changed or edited out in the manuscript.

7 Discussion

7.1 The users of the internet alcohol programs

The users of internet alcohol interventions were explicitly investigated in Study I, where all interested individuals, who had hazardous drinking, were included in the alcohol program. But information from Study II and III can also be used to understand who the users of internet alcohol programs are.

The mean age of participants in Study I was about the same age as among users in a recent meta-analysis on digital alcohol interventions. The mean age was a little higher in Study II and even higher in the Study III. But participants in all the three studies were younger than patients receiving specialized care for alcohol use disorder in Europe (J Rehm et al. 2015). Compared to specialized care for alcohol use disorder, there is a higher proportion of women in the anonymous internet interventions in Study I-II. A majority of those participants were women, which is somewhat surprising since men in the population drink more alcohol and report more alcohol dependence criteria than women do. But a higher proportion of women has also been observed in internet interventions of other psychiatric disorders. The participants in Study II and III answered demographical questions that were not included in Study I. These participants had high levels of education and employment. Most had a stable housing situation and lived with a partner or other family.

The number of weekly standard drinks consumed per user at baseline was about double the recommended limit for low-risk-drinking and similar among participants in all three intervention studies (I-III). The mean consumption was considerably lower compared to patients receiving specialized care for alcohol use disorder in Europe, but about the same as in a Swedish study of brief treatment for problematic alcohol use in a clinical setting (Andréasson et al. 2002) and in other studies on internet alcohol interventions (Riper et al. 2018). The results from Study I showed that a large majority of individuals who signed up for an internet alcohol program had alcohol use corresponding with harmful use or probable dependence. In Study II and III where alcohol use disorder was assessed, a large number of participants indicated severe alcohol use disorder. The level of alcohol use disorder and dependence was similar to a recent Swedish clinical trial in specialized and primary care, which is lower than what is usually seen in specialized care for alcohol use disorder (Wallhed Finn et al. 2018).

The people who seek support anonymously over the internet (Study I and 2) reported slightly worse health than those seeking care at the clinic (Study III). Their health was also worse than participants in the large British RCT of the Down your drink internet intervention (Essex et al. 2014). The users' scores on different dimensions of quality of life in Study I indicated poor quality of life compared to a sample from the general population in Norway, a country similar to Sweden (Mathiesen et al. 2012). Information on accessing health care should probably be given to users of internet alcohol interventions. Problems with health among participants

seem to depend on symptoms of anxiety and depression. A little less than half of participants had symptoms of depression or anxiety above the clinical cut-off that warrants further investigation. These individuals might have a need for additional program content that address their comorbidity.

Readiness to change alcohol use was generally high (9 of 10). But according to the RCQ questionnaire, 90% of the participants in Study I were in the contemplation stage. The most common day of registering for the internet program was Mondays and Sundays, when they probably experienced more of the negative consequences of their drinking than other days. This suggests that internet alcohol programs reach people that are ready to change in the moment, but who are still in a stage of contemplation and may be less committed compared to people who seek more traditional treatment for alcohol use disorder. About 1/5 of participants in all studies had talked to a professional about their alcohol consumption but five percent or less in Study II and III had received specialized care for alcohol use disorder during the last year before registering. This confirms findings from previous research showing that internet interventions are reaching a group that have not had previous treatment for their alcohol use disorder (White et al. 2010; Sundström et al. 2019).

7.2 Reasons and preferences

The reasons for using internet support that were most endorsed by participants were the ability to access *support at any time* and the possibility to be *anonymous,* which is in line with advantages highlighted in previous research (Cunningham et al. 2011; Andersson 2010). The most requested content were *Relapse prevention* and *Motivation*, which are the first and the last module in the program. Highlighting such content or developing it further could make programs more attractive to users. Highest rated features among participants were *personal feedback* and *access to a therapist*. This is in line with features associated with larger effects in a meta-regression of internet alcohol interventions (Black et al. 2016).

7.3 Use of internet alcohol programs

In the naturalistic setting most users only used a small part of the available program. When all program components were offered from start the use of the program was slightly lower, but a higher proportion achieved low-risk drinking at follow-up, compared to when the modules were released weekly. In Study II more of modules were completed by the group with therapist guidance. Higher compliance with the internet program was found in the clinic-based Study III, where more participants started the program and completed each module compared to the other studies. This may be because of a stronger commitment among these individuals, because they were reminded more frequently by their therapists or because they were identified patients.

Participants receiving therapist-guided interventions completed approximately 60% of the program in the three previous internet trials were such data is available (Postel et al. 2010;

Sundström et al. 2016; Boß et al. 2018) compared to 50% in the therapist guided group in Study II. The modules where usually used in the order they were presented even among those that got access to all modules from start. About 25% of participants in the internet-based studies never accessed the program after getting access to it. Participants in the face-to-face treatment group completed more modules than those in the internet group, but the difference was small.

7.4 Changes in alcohol use

Significant within-group changes in weekly alcohol consumption as well as all other measures of drinking quantity and frequency were found in all three studies. More than half of those who participated in follow-ups had achieved low-risk drinking or made a reliable change in problematic alcohol use as measured by Alcohol Use Disorders Identification Test (AUDIT). These reductions in alcohol consumption are similar to those observed in previous research on internet alcohol programs. But the changes could be the result of several factors which will be discussed more below.

7.5 Effects of self-help and therapist guided internet alcohol programs

The participants who received an internet program as self-help changed their alcohol use more than controls but in primary and most of the secondary outcome measures the differences were not significant. This is similar to results from the first study of Alkoholhjälpen and two other large studies of publicly available services (Cunningham 2012; Wallace et al. 2011; Sinadinovic et al. 2014).

In Study II, a therapist guided internet program was significantly more effective than information in reducing alcohol consumption, AUDIT-score and symptoms of alcohol use disorder at three months follow-up. But at six months the differences between the groups were no longer significant. The therapist guided program was not significantly more effective than the self-help program in improving any of the outcomes at follow-ups. In Study III, therapist guided internet program was no less effective in changing alcohol consumption compared to face-to-face treatment at three- and six-months follow-up. Internet treatment was also non-inferior to face-to-face in many of the secondary outcomes. This adds to the evidence from previous studies comparing face-to-face and internet alcohol interventions (Kaner et al. 2017; Kiluk et al. 2019) that shows that internet treatment has a similar effect to face-to-face treatment of alcohol use disorder.

The effect of adding therapist guidance to internet alcohol programs are still unclear. A recent large study by Boß (Boß et al. 2018) did not show any differences. The pilot study at eChange (Sundström et al. 2016) and the previous study by Blankers (Blankerset al. 2011) showed that therapist guidance was significantly more effective than self-help. A recent Swedish study found that a therapist-guided internet program was more effective in reducing number of

binge drinking days at post treatment compared to self-help. But no significant differences were found in standard drinks or at six months follow-up (Sundström et al. 2019).

The differences between the groups in Study II were smaller than in previous studies of internet alcohol interventions. There are several possible reasons for this. One is the blinding of participants. The two previous studies that have showed better effects of therapist guided intervention compared to self-help intervention, did not blind participants to the fact that they could have received a therapist. Another reason is that all groups in these studies received active interventions. Several previous trials have used waitlist controls or minimal interventions that differ clearly from the active intervention. There is a known negative effect of being put in a control group (Cunningham et al. 2013; Lindström et al. 2010) which might have been avoided by the blinded design in Study II and III. Participants in the control group in Study II reduced their alcohol consumption by eleven weekly standard drinks between baseline and three months follow-up. This might be compared to three drinks for the waiting-list in a previous study that has shown the strongest effects of an internet alcohol treatment (Postel et al. 2010).

Participants were recruited from a well-known website about changing alcohol use, which is usually found via search engines. They could be characterized as help-seekers, who had taken steps in the direction of changing their alcohol consumption by looking up and registering at the website. This was also shown by the high mean readiness to change alcohol consumption that all participants had at baseline assessment. In a recent internet alcohol treatment study a sharp decrease in alcohol consumption was noted in all groups of participants between screening and pre-treatment assessments (Sundström et al. 2019). A significant decrease in alcohol consumption and alcohol-related problems occurred in all study groups. All study participants were recruited based on their initial alcohol use and many might recently have experienced an increase in consumption or problems, which led them to seek help. Many of them might have reduced their use back to a lower level without an intervention (i.e. regression towards the mean) (McCambridge et al. 2014). All participants also had to answer a large number of assessment questions about their alcohol, an activity which has been shown to lead to reductions in alcohol consumption. (Clifford et al. 2015; McCambridge and Kypri 2011).

7.6 Other factors affecting change in drinking

The decrease in alcohol consumption and other alcohol related outcomes might also be a result of other factors connected to the intervention or to the participant. The logistic regression in Study I suggested a number of factors that contributed to changed alcohol use at follow-up. In addition to this a brief exploratory analysis of a number of factors has been conducted on data from Study II and III.

Female gender was suggested as a factor that led to less likelihood of low risk drinking in Study I. The result from Study I was probably due to the different cut-offs for men and

women regarding low risk drinking. Gender did not seem to affect the change in drinking in Study II-3. Women and men reduced their use to a similar level, but men did so from a higher baseline level. The different cut-off levels for men and women might not be as relevant for people who have reduced their drinking from a high to a more moderate level of use.

Some studies with more intensive therapist guidance have shown high effects of internet interventions. The study by Postel that showed the largest effects of a therapist-guided internet program used a high level of guidance, while the study by Boß had low intensity, with few of the participants in the therapist-guided group actually using the guidance. In Study II and III most participants used the guidance in the internet therapist groups. But we did not find any dose-response relationship between number of modules or number of comments to therapist and outcome in internet alcohol programs. There were no signs of any of the modules contributing to better effects. There was an additional effect of completing (e.g. ≥4 modules) of the program at three months follow-up, similar to what was found in Study I.

Having high or low working alliance, measured during the program, did not significantly affect changes in alcohol consumption in the studies in the current thesis. In some but not all of the previous studies of alliance in internet interventions, the alliance has been associated with outcome (Pihlaja et al. 2018; G. Andersson et al. 2012). We did not succeed in measuring the working alliance in the way that we aimed for. Most participants only rated the alliance once. With two or more ratings it would have been possible to tell if an improvement or deterioration of the alliance affected outcomes.

A little less than half of those registering a goal in the program chose a moderation goal. Those that set a goal of sobriety had reduced their drinking more at follow-up, compared to those with a moderation goal or those in the program that did not register a goal. One common objection to internet interventions has been that it is not effective for individuals with severe alcohol use disorder or heavy alcohol use. However, in Study II and III in this thesis, severe alcohol use disorder, heavy alcohol use or comorbid symptoms of anxiety or depression at baseline was not found to negatively affect the change in drinking during the intervention.

The lack of significant differences between self-help and therapist guided programs could point to common factors, rather than specific or therapist factors, being responsible for effects. But the absence of a therapist does not necessarily mean that there is no therapeutic alliance. Individuals seem to be able to form an alliance with an automatic intervention (Berman, Høybye, and Blankers 2017) or can at least rate the alliance with it. Also, the presence of a therapist does not automatically equal an alliance that leads to positive outcomes.

7.7 Experience of users

The rating of the alliance with the Session Rating Scale (SRS) was generally lower on the internet in Study I-III than what is usually expected when the SRS is used in regular therapy

(Campbell and Hemsley 2009). The alliance rating during treatment in Study III was higher in the face-to-face group compared to internet group, according to both the Working Alliance Inventory and SRS. The alliance rating in face-to-face treatment was significantly higher in all dimensions of the alliance except for in bond/relationship, which is different from what might be expected. The therapists in Study IV experienced an agreement on both goals and tasks for treatment, but described that it was harder to establish a bond in internet treatment. The users in Study I and III answered questions about their experience of treatment at the first follow-up. They rated the treatment they received as pleasant and safe, and many said that they would recommend the treatment to others. Face-to-face treatment was more appreciated than internet treatment in Study III and many in the internet group answered that they missed other forms of contact with their therapist. Different aspects of the alliance seem to be important in internet-based treatment compared to face-to-face. Maybe because the current definitions of therapeutic alliance are adapted to face-to-face meetings. Future definitions could try to incorporate the experience of internet-based therapy when defining and measuring working alliance. We are still in the early days of internet interventions and therapists will probably be able to improve the special skills that they need when doing therapy over the internet. But some patients still may feel a need for other types of contact.

7.8 Experience of therapists

In Study IV the therapists described that internet treatment has both advantages and disadvantages and might not be for everyone. The special way of communicating can give both users and therapists more time to think and reflect about what they want to express but can make it harder to understand details. Many of the differences described by the therapists were in line with the experience of internet-based treatment as described by patients in previous research (Knowles et al. 2014; Verhoeks et al. 2017). The therapists highlighted the importance of anonymity, which is in line with the results in the survey of participants that rated anonymity as one of the most important reasons for choosing internet support. The possibility to be anonymous can reduce social barriers to self-disclosure, which might be important for people who have experienced stigma or shame in relation to their alcohol use disorder. There is a qualitative difference when it comes to the relationship and therapeutic alliance with internet patients compared to face-to face patients. The therapists describe that they try to find a common language and a correct tone in communicating with users. Internet interventions can be seen as less demanding or as requiring less commitment and this could be one of the reasons for trying it. Users in internet programs might to a less extent experience themselves as being in treatment. Some patients work mostly on their own with the program and do not rely on communicating with the therapist. Other patients communicate more and seem to want a closer relationship. There seems to be a shift in responsibility and in power in internet treatment to a more equal relationship, similar to the partnership that is preferred in Motivational Interviewing (Moyers 2014). But there is also a clear continuum in internet interventions from a high level of contact to a high level of independence (Holst et al. 2017). Internet therapists need to find the correct level of contact for each patient, which might be affected by the patients readiness to change, their expectations on treatment and the setting

where the internet program is offered. For example, a higher proportion of participants in the internet group at the clinic (Study III) said that they missed other forms of contact with the therapist, compared with the anonymous users in Study I. All patients probably need both connection, collaboration, independence and self-efficacy (Knowles et al. 2014). The option of internet programs might help each patient to find the best balance. Internet treatment can be improved if the users that need a closer relationship with a therapist can be identified early in the intervention. Some aspects of working as a therapist with internet programs can make it less tiring. The program and setting gives increased focus on the task and the goal of the program. Also, the therapist might not get so emotionally involved. Compared to face-to-face, internet treatment can provide more work-time control and buffer therapist exhaustion.

7.9 Generalizability

The generalizability of the results in the Study I-III are limited to people seeking help for their drinking and who are interested in internet interventions. In the Study I and II we aimed to come as close as possible to the intended target group of the intervention when used in regular service at Alkoholhjälpen. The study was conducted in that setting with participants who had found the service on their own. There were no differences in AUDIT-score or alcohol dependence criteria between those who accepted and those who declined participation in Study II. The generalizability to regular services on Alkoholhjälpen and similar sites is therefore good. The results cannot be generalized to all people with alcohol use disorder. The participants in Study II and III were mostly well-educated, employed full-time and had stable living arrangements. Participants in all three studies had lower severity of alcohol use disorder and comorbid psychiatric problems than those who usually receive specialized such treatment. But participants in our studies are representative of the majority of individuals with alcohol use disorder (Andreasson et al. 2013), a population who do not seek traditional treatment for alcohol use disorder but might be reached via internet interventions like Alkoholhjälpen.

7.10 Limitations

Like in much of the previous research on internet alcohol interventions (Eysenbach 2005), the biggest limitation in Studies I-III is loss of participants at follow-up. In the naturalistic setting in Study I the attrition was even higher in this than in previous studies. In Study II, we made extra efforts to reduce the attrition. We reminded participants more on both email and SMS and gave out tablets to every 460th participant that completed a follow-up. Still there were high numbers lost to follow-up. The highest rate of follow-up was in Study III, where participants were identified and had visited the clinic at the start of the study. The users who did not participate in follow up had higher alcohol consumption and more problems with alcohol use disorder and health at baseline. But there were no differences in these baseline values between groups. We do not know how the lost individuals were doing at follow-up. Our additional analysis shows that people with higher level of problems at baseline actually had changed their drinking more. The absence of change might reduce participants

interest in completing the follow-up. But it could also work the other way around, when follow-up is conducted on the web without meeting anyone. Several participants answered reminders with statements about not needing the service anymore, because they did not experience any more problems. The attrition might have been affected by the large number of questions in the follow-up. But also, a consequence of allowing users a fast and accessible way of signing up for participation anonymously, were many never came back to the intervention after recruitment. A reasonable assumption is that users were missing at random. There were no significant differences between the intervention groups in the number of participants not completing follow-up. The studies did not include design aspects that could introduce non-random missingness, i.e. reporting outcome to therapist.

Adherence to the program was relatively low in Study I and II. Again this is similar to many studies of internet interventions. If more participants had completed more of the intervention it might have strengthened the effects of the intervention. One possible explanation mentioned by the therapist in Study IV is that patients in internet treatment are not so concerned about their therapists. If they experience that they do not need more treatment or that the program is not working, it is probably easier to drop out from an internet program than not showing up for a face-to-face appointment. This is a product of the increased autonomy and individual responsibility in anonymous internet treatment and should not necessarily been seen as a problem. Patients who continue in treatment due to obligations to the therapist might make the treatment purposeless. Also, the participants in Study I and II were instructed to use as much of the program as they wanted. They received reminders about using the program, but no warnings.

In Study IV the generalisability of the findings is limited by the sample of therapists; all of them lived in Stockholm and worked with Cognitive Behavioural Therapy (CBT) based programs, but also by the researchers own understandings and preconceptions concerning alcohol treatment and internet interventions. By combining the position of being very familiar or inside and the more distanced outsider position, we hope to have strengthened the reliability of our study. Another limitation is how data was collected. In focus group interviews, there is a risk of peer pressure and dominant participants that take over the discussion. Participants were encouraged to engage in the conversation and directed follow up questions were used to involve the more silent participants.

7.11 Strengths

All four studies included in this thesis are some of the largest of their kind to date. They reached a large number of people with alcohol use disorder where a majority did not have previous support. The large number of participants gave sufficient power to also investigate how different factors, other than group allocation, might affect alcohol use and treatment response. Another strength is the high ecological validity. Participation in Study I and II were accessible to all help-seeking individuals with alcohol use disorder that visited a well-established Swedish web-portal. Study III was conducted in a dependency clinic with regular

patients and treatments that were well established in both modes of delivery. Because of the high degree of Internet usage in Sweden, the results from these studies can also provide a better understanding of users beyond early adopters of internet interventions that might have been over-represented in earlier research. Study III is the first study showing that internet-based treatment is not inferior to face-to-face treatment for alcohol use disorder in reducing alcohol consumption as well as alcohol use disorder, anxiety and depression. Another strength in Study III was that the same therapists and the same treatment material was used in both the internet and face-to-face group. Study IV is one of relatively few qualitative studies of internet alcohol intervention and of therapist perceptions in internet treatment. A strength compared to other similar studies is that therapists that primarily work on the internet, as well as therapists that no longer do it, where represented. Some of them said that they prefer working via internet and others said that they prefer meeting patients face-to-face. The qualitative data from Study IV has also provided better understanding for some of the quantitative findings in Studies I-III in this thesis.

7.12 Future directions

Despite many studies and several meta-analyses, there is still a need for more studies on internet alcohol interventions. Especially studies on more extended programs and studies in clinical settings. There is a lack of tightly controlled studies of internet alcohol programs where the intervention is given ideal conditions to work. Most previous studies have aimed at ecological validity and effectiveness rather than efficacy. Studies with long-term follow-ups are also important to ensure that users of internet alcohol programs do not return to harmful alcohol use (Danielsson et al. 2014). Treatment seeking increases the rates of recovery from alcohol dependence (Trim et al. 2013) and internet interventions seem to be a possible way to reach individuals with alcohol use disorder who are currently not seeking treatment, which is again shown in Study I-II in this thesis. But it is still unclear if internet alcohol interventions actually increase treatment seeking compered to face-to-face interventions on a population level and studies should test that hypothesis.

An important challenge for future studies on the internet is to improve follow-up rates as well as adherence to interventions. But this should be done without reducing the willingness to use the interventions in the group of people that have not been willing to seek traditional care for their alcohol use disorder. Increased demands on users to identify themselves or have contact with a professional might make people, who wish to stay anonymous or feel ashamed or stigmatized, more reluctant to use internet interventions. A couple of studies on internet alcohol interventions have relatively high (>80%) follow-up rate (Cunningham 2012; Cunningham 2017). They used written consent by postal mail to the participants home address and a combination of postal mail or web-based follow-up with incentives for every follow-up that the user sent in.

There is a hesitation among researchers to use non-inferiority design because of the complexity involved. One of the most influential studies within the field of alcohol use disorders (MATCH) failed to find support for most superiority hypotheses (Allen et al. 1997); instead the treatments in the trial appeared to have similar effect. From a clinical perspective it makes sense to use a non-inferiority design, were two conditions both can be given equal opportunity to be effective. The use of waiting-lists or second-rate treatments in clinical settings have ethical problems and can make the results hard to interpret. There is a need for better research designs and statistical methods that are more adapted to testing psychological treatments in real-life clinical settings.

The current trials only measured outcomes at two or three timepoints. More timepoints during the intervention can allow more flexibility in the statistical modelling approach and also allows for better examination of moderators and mediators (Hesser 2015). But this might lead to additional problems with missing data, and since measuring in it-self can promote changes in alcohol-use, it can make it harder to separate the effects of the follow-ups from the intervention. One possible strategy could be to try to integrate measures in the intervention, make it more relevant for the user to complete the program and try to strengthen adherence with incentives. Data from a drinking-calendar could be used as outcome and can predict future drinking (Lindner et al. 2018). Better reminders are important to keep users engaged, but increasingly difficult to get through in the flood of spam mails and other messages.

In Study II all the groups had access to a well-established and moderated discussion forum, which might have affected their alcohol use (Sinclair et al. 2017; Cunningham et al. 2008). Discussion forums have been used as control groups in studies of other internet interventions with the assumption that they are not effective. But to use an active discussion with dedicated users who support each-other, can work in a similar way as self-help groups and might be an effective form of support that should be further studied.

There are many different options for using internet interventions in the clinical treatment of alcohol use disorders. In sparsely populated countries such as Sweden, where some people have to travel far to visit a clinic in person, both psychological treatment (Kay-Lambkin et al. 2012), medical management (Devine et al. 2016) and after-care (Gustafson et al. 2014) could in part be handled with internet interventions. Internet alcohol programs can be used to treat alcohol use disorders in primary care (Hyland et al. 2019). Some studies have shown that digital alcohol treatment can increase the effects of treatment as usual (Kiluk et al. 2019). Other therapeutic methods for alcohol treatment, than MI and CBT, can also be developed and tested for the internet. They might not be expected to show improved effects on alcohol consumption from available methods, but can attract and help those individuals that do not get effects from the methods that are currently available. Internet interventions have lower costs of delivery than traditional treatment (Blankers et al. 2012), but there is not enough evidence of cost-effectiveness in clinical settings. We need more studies that help us

understand how internet interventions can be used effectively to improve the treatment for people with alcohol use disorder.

We still do not know much about who should be offered internet alcohol programs. The studies in this thesis show that comorbid anxiety and depression or severe alcohol use disorder do not seem to hinder internet alcohol programs from being effective in reducing alcohol consumption. But about a fifth of participants in the studies in this thesis did not change their problematic use and some showed signs of deterioration. It is important to find out more about those who do not respond to internet alcohol interventions. Studies have so far not reported much side-effects of using internet alcohol interventions, but better questions or measures should be used in future studies to ensure that adverse effects are not missed (Rozental et al. 2015). Both difficulties and risks of delivering or receiving alcohol treatment via internet need to be studied more carefully.

Most internet help-seekers might not need therapist guidance in order to change their drinking when they use internet interventions. Others, who do not improve, might benefit from more intensive support. There is a lack of evidence for the hypothesis of matching alcohol use disorder patients to treatment based on base-line characteristics. Stepped care, support-on-demand or adaptive treatment strategies (Forsell et al. 2020) could be tried in future studies on internet alcohol interventions. Better tailoring of interventions to user needs should also be tried out; for example, by identifying and addressing co-occurring problems or helping people transition between internet interventions and other types of support. There are many evidence-based internet programs available for a wide range of psychiatric disorders (e.g. anxiety, depression, stress, insomnia) (Andersson et al. 2019) that could be combined with internet alcohol programs for people with comorbid problems.

Investigating factors that might affect outcome in internet alcohol programs can be done through machine-learning were patterns of predictors might be used instead of theory driven testing of different parameters. The advantage of using digital interventions for this is that there is usually a lot of information gathered in the interventions that could be used for making predictions. Future internet programs might also try to use systems for feedback from patients (Miller et al. 2015) that can help therapists prevent drop-out that are related to the alliance between therapist and user. Patient's perspectives on internet alcohol programs and how they perceive aspects like alliance should also be further studied.

7.13 Some reflections on the results

Is the glass half empty or half full? The results of Study I-III can be interpreted in different ways, related to this common expression. In the peer review process of Study II, we were asked if the results indicated that we should stop using therapist guided internet programs for the target-group, since it only showed advantage on some measures and time points. The same question could also be asked regarding internet self-help, which was not more effective

than control. On the other hand, when the same program was used in Study III, it had very similar effects on drinking as the face-to-face treatment, which was similar in content to many forms of Cognitive Behavioural Therapy for substance use disorders (Magill and Ray 2009). So, the answer to the main question - if an internet intervention is an effective treatment option for people with alcohol use disorder – depends on how the overall evidence for both internet and face-to-face interventions of alcohol use disorders are interpreted. Many different interventions seem to produce change in alcohol use. The most recent meta-analysis on twelve-step and cognitive behavioural treatments, did not find significant differences when they were compared to other specific treatments. The dodo-bird verdict (i.e. all therapies are equally effective) seem to still be alive in treatment of alcohol use disorders. It is important to note that this verdict refers to differences between established therapies, not doing just anything.

But do we need to treat people with alcohol use disorders at all or will they find ways to change by themselves? Some of the reduction in alcohol use over time seen in trials is not related to treatment and could be observed when just measuring peoples drinking at two time points (McCambridge et al. 2014), but not all of it. There seem to be at least some additional effect of alcohol treatment. An important thing that internet interventions can add is that it will get more people to take the first step. Broadening the base of alcohol treatment (Institute of Medicine 1990) to allow more people to find ways of changing their alcohol use problems is still what both researchers and clinicians should focus their work on. Internet alcohol interventions should at this point be recognized as one of the established ways to deliver prevention and treatment.

7.14 Conclusion

Users of the internet alcohol program at Alkoholhjälpen have considerable problems with alcohol and health. They change their alcohol use, symptoms of alcohol used disorders, anxiety and depression, with moderate to large within-group effect sizes at follow-up. Individuals choose internet support because it is easy to access and because it is possible to be anonymous. The way of communicating makes therapist guided internet treatment, different from face-to-face treatment and this affect the alliance between the therapist and the user. Different forms of internet alcohol interventions for alcohol use disorders do not seem to have significantly different effects. Guided internet programs can be more effective than information only. Guided internet treatment is no less effective than corresponding face-to-face treatment for alcohol use disorder.

Internet alcohol interventions are an effective treatment alternative. Even if there is room for improvement, the support for this conclusion is now similar to that of other forms of interventions for alcohol use disorders.

8 Acknowledgements

A thesis like this is not the work of one person. In my case I have had the privilege of being supported by some amazing people over the years. Without these people, and the support they have given me, this work would never have been done. Thank you,

To my supervisors:
Main supervisor **Sven Andréasson** – Thank you for bringing me along in some of all the important work that you have initiated within our field. Even if I did not pick up on your early invitations to get into research, you have always continued to encourage me. Your support has been essential for my continued work with internet interventions and finally, some twenty years later, we are here.
Co-supervisor **Anne H Berman**, – Thank you MINT-classmate, for creating discrepancy which developed to intrinsic motivation for doing my own research by encouraging me to "try to do it better yourself", many years ago. Thank you also for your leadership in research regarding internet interventions for alcohol and drug problems.
Co-supervisor **Ulric Hermansson** – Thank you social-work 'brother', for always taking the time to discuss and help me solve problems. Also, thank you for helping me formulate the right questions early on in planning and funding the studies.
Co-supervisor **Kristina Sinadinovic** – Thank you for doing the first research involving Alkoholhjälpen and for always being so thorough in creating protocols and improve manuscripts.

To my external mentor, **Niklas Waitong** – Big älg thank you for everything you have taught me and for always being a good friend. Thank you and also **Gunnar Lindfeldt**, for the recurring discussions about research and practice in our field, which have given me much needed perspective.

To my Co-authors:
Anders Hammarberg, for your important contribution to the continued research at Riddargatan 1 and for your help on how to finalize a manuscript. **Veronica Ekström** for helping me unravel how to do qualitative research studies and getting it published. **Christopher Sundström** for the cooperation with eChange. **Mikael Gajecki** for joining us at eStöd with your experience and stability. **Philip Lindner** for your patient explanations and competent help with statistics, and for bringing a lot of new interesting projects to eStöd

To my fellow PhD students at Riddargatan 1 and eStöd:
Sara Wallhed, for your work on the first self-help material at Riddargatan 1 and for always taking time for discussing my questions and thoughts. **Ola Siljeholm** and **Karin Romberg** for your help in improving the internet program and for taking the CSO work to new heights. **Karin Hyland,** for your help with Study III and for spreading internet alcohol interventions to primary care. **Victoria Andersson**, for your fantastic work with recruitment and follow-ups in Study III. **Stina Ingesson** for your patients. **Miriam Jacobson**, for all your work with the internet treatment in study II and III.

To **Sven Wåhlin** for sharing all your knowledge thru the years as my colleague and for assessing patients in Study III.

To the counselors at Alkoholhjälpen and Droghjälpen:
Liselott Sahlberg and **Rosette Lind** for your MI wisdom and for all your help in study II. **Kristoffer Bäckström** for your help with translations. **Sofia Vänelid** for taking care of all the parents. **Nelleke Heinemans** for bringing hjälpen and linjen closer. **Carina Bång** for all your work with family members. **Ann-Sofie Johansson** for bringing me into the world of cannabis and for all the interesting discussions.

To all my great colleagues at **eStöd**, including **Alkohollinjen**, and at **Riddargatan 1**.

To my amazing bosses, **Ylva Nork** and **Kerstin Annerborn** for your good leadership and for supporting me in the work with this thesis.

To the **participants** in Study I-III, thank you for your help.

To **all the users at Alkoholhjälpen** and **patients at Riddargatan 1** - you will always be the most important source of knowledge and for inspiration in my work. A special thanks to the following users who have contributed with more than a thousand comments in the forum: **mulletant, Adde, aeromagnus, AlkoDHyperD, Andrahalvlek, anonyMu, Bedrövad-sambo, Berra, Dionysa, Dompa, Ebba, Erik, Femina, Fenix, Fibblan, FinaLisa, Gunda, Ikaros, IronWill, Jasmine, JoYo, LenaNyman, Leverjag, Mirabelle, miss lyckad, Monday-Morning, nystart, Nordäng67, Sisyfos, Se klart, Stigsdotter, John-Erik, Sofia, santorini, Ullabulla, vill.sluta, Vinäger.**

To **Stockholm Centre for Dependence Disorders** for providing a platform for research and letting us develop internet intervention at the clinic. A special thank you to **Helena von Schewen** at Maria Ungdom for all the support.

To **ALF** Region Stockholm, **SRA** and **FORTE**, thank you for funding the studies, that made this possible. To the **Doctoral School in Healthcare Sciences**, Karolinska Institutet, for supporting me and the project.

To my family:
My mother **Agneta** and father **Sven** who have always encouraged me to acquire my own knowledge, from the bookshelf, from the university and from life. To my sister **Åse** and brother **Niklas**, for all our discussions. To my aunt **Ingrid**, for leading the way in to academia and to the big city. My wonderful kids **Emanuel** and **Saskia**. Thank you for being supportive and understanding when "dad needed to study".

To the love of my life **Emelie Stachewsky.** Being with you is always uncomplicated and simply good. Thank you for your unconditional support for my work with this thesis, even when everything seems to happen at the same time.

References

Acosta, M. C., Possemato, K., Maisto, S. A., Marsch, L. A., Barrie, K., Lantinga, L., … Rosenblum, A. (2017). Web-Delivered CBT Reduces Heavy Drinking in OEF-OIF Veterans in Primary Care With Symptomatic Substance Use and PTSD. *Behavior Therapy*, *48*(2), 262–276.

Adamson, S. J., Sellman, J. D., & Frampton, C. M. A. (2009). Patient predictors of alcohol treatment outcome: A systematic review. *Journal of Substance Abuse Treatment*, *36*(1),

Agyapong, V. I. O., Ahern, S., McLoughlin, D. M., & Farren, C. K. (2012). Supportive text messaging for depression and comorbid alcohol use disorder: Single-blind randomised trial. *Journal of Affective Disorders*, *141*(2–3), 168–176.

Allebeck, P., Andreasson, S., Wåhlin, S., Ramstedt, M., Gripenberg, J., Damström-Thakker, K., & Heinemans, N. (2018). *Alkoholkonsumtion och risknivåer. Kunskapsunderlag och förslag till rekommendationer*.

Allen, J. P., Anton, R. F., Babor, T. F., Carbonari, J., Carroll, K. M., Coonors, G. J., … Zweben, A. (1998). Matching alcoholism treatments to client heterogeneity: Treatment main effects and matching effects on drinking during treatment. *Journal of Studies on Alcohol*, *59*(6), 631–639.

Allen, J. P., Mattson, M. E., Miller, W. R., Tonigan, J. S., Connors, G. J., Rychtarik, R. G., … Sturgis, E. (1997). Matching alcoholism treatments to client heterogeneity: Project MATCH posttreatment drinking outcomes. *Journal of Studies on Alcohol*, *58*(1), 7–29.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.

Andersson, C. (2015). Comparison of WEB and Interactive Voice Response (IVR) Methods for Delivering Brief Alcohol Interventions to Hazardous-Drinking University Students: A Randomized Controlled Trial. *European Addiction Research*, *21*(5), 240–252.

Andersson, G. (2010). The promise and pitfalls of the internet for cognitive behavioral therapy. *BMC Medicine*, *8*(1), 82.

Andersson, G., Paxling, B., Wiwe, M., Vernmark, K., Felix, C. B., Lundborg, L., … Carlbring, P. (2012). Therapeutic alliance in guided internet-delivered cognitive behavioural treatment of depression, generalized anxiety disorder and social anxiety disorder. *Behaviour Research and Therapy*, *50*(9), 544.

Andersson, G., Titov, N., Dear, B. F., Rozental, A., & Carlbring, P. (2019). Internet-delivered psychological treatments: from innovation to implementation. *World Psychiatry*, *18*(1), 20–28.

Andrade, A. L. M., de Lacerda, R. B., Gomide, H. P., Ronzani, T. M., Sartes, L. M. A., Martins, L. F., … Schaub, M. P. (2016). Web-based self-help intervention reduces alcohol consumption in both heavy-drinking and dependent alcohol users: A pilot study. *Addictive Behaviors*, *63*, 63–71.

Andreasson, S., Danielsson, A.-K. K., Hallgren, M., Andréasson, S., Danielsson, A.-K. K., Hallgren, M., … Hallgren, M. (2013). Severity of alcohol dependence in the Swedish adult population: Association with consumption and social factors. *Alcohol*, *47*(1), 21–25.

Andréasson, S, & Allebeck, P. (2005). *Alkohol och Hälsa: en Kunskapsöversikt om Alkoholens Positiva och negativa effekter på vår Hälsa [Alcohol and Health. A Knowledge Review of Positive and Negative Health Consequences of Alcohol], Report R 2005: 11. The Swedish National Institute of Public Health, Stockholm, Sweden (in Swedish)*.

Andréasson, Sven, Danielsson, A. K., & Wallhed-Finn, S. (2013). Preferences regarding treatment for alcohol problems. *Alcohol and Alcoholism*, *48*(6), 694–699.

Andréasson, Sven, Hansagi, H., & Österlund, B. (2002). Short-term treatment for alcohol-related problems: Four-session guided self-change versus one session of advice - A randomized, controlled trial. *Alcohol*, *28*(1), 57–62.

Anton, R. F., O'Malley, S. S., Ciraulo, D. A., Cisler, R. A., Couper, D., Donovan, D. M., … COMBINE Study Research Group, for the. (2006). Combined Pharmacotherapies and Behavioral

Interventions for Alcohol Dependence. *JAMA*, *295*(17), 2003.

Apodaca, T. R., & Longabaugh, R. (2009). Mechanisms of change in motivational interviewing: a review and preliminary evaluation of the evidence. *Addiction*, *104*(5), 705–715.

Apodaca, T. R., & Miller, W. R. (2003). A meta-analysis of the effectiveness of bibliotherapy for alcohol problems. *Journal of Clinical Psychology*.

Babor, T., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., … Holder, H. (2010). *Alcohol: No Ordinary Commodity: Research and public policy*. New York: Oxford University Press.

Baldwin, J. D., & Baldwin, J. I. (2001). *Behavior principles in everyday life*. Pearson College Division.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191.

Barrio, P., Ortega, L., López, H., & Gual, A. (2017). Self-management and shared decision-making in alcohol dependence via a mobile app: a pilot study. *International Journal of Behavioral Medicine*, *24*(5), 722–727.

Beck, A. T., Wright, F. D., Newman, C. F., & Liese, B. S. (1993). *Cognitive Therapy of Substance Abuse*. Guilford Publications.

Becker, H. C. (2008). Alcohol Dependence, Withdrawal, and Relapse. In *Neurobiology of Alcohol Dependence* (pp. 377–410). Elsevier.

Bendtsen, P., Bendtsen, M., Karlsson, N., White, I. R., & McCambridge, J. (2015). Online alcohol assessment and feedback for hazardous and harmful drinkers: Findings from the AMADEUS-2 randomized controlled trial of routine practice in Swedish universities. *Journal of Medical Internet Research*, *17*(7), 1–15.

Bendtsen, P., McCambridge, J., Bendtsen, M., Karlsson, N., & Nilsen, P. (2012). Effectiveness of a proactive mail-based alcohol internet intervention for university students: Dismantling the assessment and feedback components in a randomized controlled trial. *Journal of Medical Internet Research*, *14*(5), 1–12.

Bengtsson, J., Nordin, S., & Carlbring, P. (2015). Therapists' Experiences of Conducting Cognitive Behavioural Therapy Online vis-à-vis Face-to-Face. *Cognitive Behaviour Therapy*, *44*(6), 470–479.

Berger, T. (2017). The therapeutic alliance in internet interventions: A narrative review and suggestions for future research. *Psychotherapy Research*, *27*(5), 511–524.

Bergman, H., Kallmen, H., Källmén, H., & Kallmen, H. (2002). Alcohol use among Swedes and a psychometric evaluation of the Alcohol Use Disorders Identification Test. *Alcohol and Alcoholism*, *37*(3), 245–251.

Berkowitz, A. D. (2005). An overview of the social norms approach. In *Changing the Culture of College Drinking: A Socially Situated Prevention Campaign* (pp. 193–214).

Berman, A. H., Høybye, M. T., & Blankers, M. (2017). Editorial on IJBM Special Issue—E-Health Interventions for Addictive Behaviors. *International Journal of Behavioral Medicine*, *24*(5), 641–645.

Bertholet, N., Cheng, D. M., Palfai, T. P., Samet, J. H., & Saitz, R. (2009). Does readiness to change predict subsequent alcohol consumption in medical inpatients with unhealthy alcohol use? *Addictive Behaviors*, *34*(8), 636–640.

Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *Journal of Psychosomatic Research*, *52*(2), 69–77.

Black, N., Mullan, B., & Sharpe, L. (2016). Computer-delivered interventions for reducing alcohol consumption: meta-analysis and meta-regression using behaviour change techniques and theory. *Health Psychology Review*, *10*(3), 341–357.

Blankers, M., Koeter, M. W. J., & Schippers, G. M. (2011). Internet therapy versus internet self-help

versus no treatment for problematic alcohol use: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*, *79*(3), 330–341.

Blankers, M., Koeter, M. W. J., & Schippers, G. M. (2013). Baseline predictors of treatment outcome in Internet-based alcohol interventions: a recursive partitioning analysis alongside a randomized trial. *BMC Public Health*, *13*(1), 455.

Blankers, M., Nabitz, U., Kerssemakers, R., Schramade, M., & Schippers, G. (2008). Internet-based self-help for problem drinkers: Initial results. *Sucht*, *54*(5), 280–288.

Blankers, M., Nabitz, U., Smit, F., Koeter, M. W. J., & Schippers, G. M. (2012). Economic evaluation of internet-based interventions for harmful alcohol use alongside a pragmatic randomized controlled trial. *Journal of Medical Internet Research*, *14*(5), e134.

Blomqvist, J. (1996). Paths to recovery from substance misuse: Change of lifestyle and the role of treatment. *Substance Use and Misuse*, *31*(13), 1807–1852.

Blomqvist, J. (2002). *Beyond treatment? Widening the approach to alcohol problems and solutions*. Stockholm University.

Bordin, E. S. (1979). The generalizability of the psychoanalytic concept of the working alliance. *Psychotherapy: Theory, Research & Practice*, *16*(3), 252–260.

Boß, L., Lehr, D., Schaub, M. P., Paz Castro, R., Riper, H., Berking, M., & Ebert, D. D. (2018). Efficacy of a web-based intervention with and without guidance for employees with risky drinking: results of a three-arm randomized controlled trial. *Addiction*, *113*(4), 635–646.

Brendryen, H., Johansen, A., Duckert, F., & Nesvåg, S. (2017). A Pilot Randomized Controlled Trial of an Internet-Based Alcohol Intervention in a Workplace Setting. *International Journal of Behavioral Medicine*, *24*(5), 768–777.

Brendryen, H., Lund, I. O., Johansen, A. B., Riksheim, M., Nesvåg, S., & Duckert, F. (2014). Balance-a pragmatic randomized controlled trial of an online intensive self-help alcohol intervention. *Addiction*, *109*(2), 218–226.

Brief, D. J., Rubin, A., Keane, T. M., Enggasser, J. L., Roy, M., Helmuth, E., … Rosenbloom, D. (2013). Web intervention for OEF/OIF veterans with problem drinking and PTSD symptoms: A randomized clinical trial. *Journal of Consulting and Clinical Psychology*, *81*(5), 890.

Bruun, K. (1975). Alcohol control policies: in public health perspective.

Campbell, A., & Hemsley, S. (2009). Outcome rating scale and session rating scale in psychological practice: Clinical utility of ultra-brief measures. *Clinical Psychologist*, *13*(1), 1–9.

Campbell, A. N. C., Nunes, E. V., Matthews, A. G., Stitzer, M., Miele, G. M., Polsky, D., … Ghitza, U. E. (2014). Internet-delivered treatment for substance abuse: A multisite randomized controlled trial. *American Journal of Psychiatry*, *171*(6), 683–690.

CAN. (2017). *Drug Trends in Sweden 2017. Alcohol*.

Caputo, F., Vignoli, T., Tarli, C., Domenicali, M., Zoli, G., Bernardi, M., & Addolorato, G. (2016). A brief up-date of the use of sodium oxybate for the treatment of alcohol use disorder. *International Journal of Environmental Research and Public Health*, *13*(3), 1–6.

Carroll, K. M., Ball, S. A., Martino, S., Nich, C., Babuscio, T. A., Nuro, K. F., … Rounsaville, B. J. (2008). Computer-assisted delivery of cognitive-behavioral therapy for addiction: a randomized trial of CBT4CBT. *American Journal of Psychiatry*, *165*(7), 881–888.

Carter, B. L., & Tiffany, S. T. (1999). Meta-analysis of cue-reactivity in addiction research. *Addiction*, *94*(3), 327–340.

Carvalho, A. F., Heilig, M., Perez, A., Probst, C., & Rehm, J. (2019). Alcohol use disorders. *The Lancet*, *394*(10200), 781–792.

Casswell, S., You, R. Q., & Huckle, T. (2011). Alcohol's harm to others: Reduced wellbeing and health status for those with heavy drinkers in their lives. *Addiction*, *106*(6), 1087–1094.

Cavanagh, K., & Millings, A. (2013). (Inter)personal computing: The role of the therapeutic relationship in E-mental health. *Journal of Contemporary Psychotherapy*, *43*(4), 197–206.

Chambers, S. E., Canvin, K., Baldwin, D. S., & Sinclair, J. M. A. (2017). Identity in recovery from problematic alcohol use: A qualitative study of online mutual aid. *Drug and Alcohol Dependence*, *174*, 17–22.

Christiansen, P., Cole, J. C., & Field, M. (2012). Ego depletion increases Ad-Lib alcohol consumption: Investigating cognitive mediators and moderators. *Experimental and Clinical Psychopharmacology*, *20*(2), 118–128.

Clarke, T. K., Adams, M. J., Davies, G., Howard, D. M., Hall, L. S., Padmanabhan, S., … McIntosh, A. M. (2017). Genome-wide association study of alcohol consumption and genetic overlap with other health-related traits in UK biobank (N=112117). *Molecular Psychiatry*, *22*(10), 1376–1384.

Clifford, P. R., Maisto, S. A., & Davis, C. M. (2015). Alcohol Treatment Research Assessment Exposure Subject Reactivity Effects: Part I. Alcohol Use and Related Consequences. *Journal of Studies on Alcohol and Drugs*, *68*(4), 519–528.

Cloninger, C. R. (1981). Inheritance of Alcohol Abuse. *Archives of General Psychiatry*, *38*(8), 861.

Cloud, R. N., & Peacock, P. L. (2001). Internet screening and interventions for problem drinking: Results from the www.carebetter.com pilot study. *Alcoholism Treatment Quarterly*, *19*(2), 23–44.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences New York. *NY: Academic*.

Cole, H. A., Prassel, H. B., & Carlson, C. R. (2018). A meta-analysis of computer-delivered drinking interventions for college students: A comprehensive review of studies from 2010 to 2016. *Journal of Studies on Alcohol and Drugs*, *79*(5), 686–696.

Collins, S. E., Carey, K. B., & Smyth, J. (2005). Relationships of linguistic and motivation variables with drinking outcomes following two mailed brief interventions. *Journal of Studies on Alcohol*, *66*(4), 526–535.

Copeland, J. (2011). Application of technology in the prevention and treatment of substance use disorders and related problems: Opportunities and challenges. *Substance Use and Misuse*, *46*(1), 112–113.

Crombie, I. K., Irvine, L., Falconer, D. W., Williams, B., Ricketts, I. W., Jones, C., … Rice, P. (2017). Alcohol and disadvantaged men: a feasibility trial of an intervention delivered by mobile phone. *Drug and Alcohol Review*, *36*(4), 468–476.

Cunningham, John A., & Blomqvist, J. (2006). Examining treatment use among alcohol-dependent individuals from a population perspective. *Alcohol and Alcoholism*.

Cunningham, John A., Shorter, G. W., Murphy, M., Kushnir, V., Rehm, J., & Hendershot, C. S. (2017). Randomized Controlled Trial of a Brief Versus Extended Internet Intervention for Problem Drinkers. *International Journal of Behavioral Medicine*, *24*(5), 760–767.

Cunningham, John A., van Mierlo, T., & Fournier, R. (2008). An online support group for problem drinkers: AlcoholHelpCenter.net. *Patient Education and Counseling*, *70*(2), 193–198.

Cunningham, John A, Kypri, K., & McCambridge, J. (2013). Exploratory randomized controlled trial evaluating the impact of a waiting list control design. *BMC Medical Research Methodology*, *13*(1), 150.

Cunningham, John A, Kypri, K., Mccambridge, J., Ph, D., Kypri, K., Ph, D., … Ph, D. (2011). The use of emerging technologies in alcohol treatment. *Alcohol Research & Health*, *33*(4), 320.

Cunningham, John A, Selby, P. L., Kypri, K., & Humphreys, K. N. (2006). Access to the Internet among drinkers, smokers and illicit drug users: Is it a barrier to the provision of interventions on the World Wide Web? *Informatics for Health and Social Care*, *31*(1), 53–58.

Cunningham, John Alastair. (2012). Comparison of two internet-based interventions for problem drinkers: Randomized controlled trial. *Journal of Medical Internet Research*, *14*(4), e107.

Dale, V., Heather, N., Adamson, S., Coulton, S., Copello, A., Godfrey, C., … Tober, G. (2017). Predicting drinking outcomes: Evidence from the United Kingdom Alcohol Treatment Trial (UKATT). *Addictive Behaviors*, *71*, 61–67.

Danielsson, A.-K., Eriksson, A.-K., & Allebeck, P. (2014). Technology-based support via telephone or web: A systematic review of the effects on smoking, alcohol use and gambling. *Addictive Behaviors*, *39*(12), 1846–1868. Davies, E. L., Maier, L. J., Winstock, A. R., & Ferris, J. A. (2019). Intention to reduce drinking alcohol and preferred sources of support: An international cross-sectional study. *Journal of Substance Abuse Treatment*, *99*, 80–87.

Dear, B. F., Titov, N., Sunderland, M., McMillan, D., Anderson, T., Lorian, C., & Robinson, E. (2011). Psychometric comparison of the Generalized Anxiety Disorder Scale-7 and the Penn State Worry Questionnaire for measuring response during treatment of Generalised Anxiety Disorder. *Cognitive Behaviour Therapy*, *40*(3), 216–227.

Deci, E. L., & Ryan, R. M. (2004). *Handbook of self-determination research*. University Rochester Press.

Degenhardt, L., Glantz, M., Evans-Lacko, S., Sadikova, E., Sampson, N., Thornicroft, G., … Zaslavsky, A. M. (2017). Estimating treatment coverage for people with substance use disorders: an analysis of data from the World Mental Health Surveys. *World Psychiatry*, *16*(3), 299–307.

Devine, E. G., Ryan, M. L., Falk, D. E., Fertig, J. B., & Litten, R. Z. (2016). An exploratory evaluation of Take Control: A novel computer-delivered behavioral platform for placebo-controlled pharmacotherapy trials for alcohol use disorder. *Contemporary Clinical Trials*, *50*, 178–185.

Donker, T., Blankers, M., Hedman, E., Ljotsson, B., Petrie, K., & Christensen, H. (2015, December 3). Economic evaluations of Internet interventions for mental health: A systematic review. *Psychological Medicine*. Cambridge University Press.

Donoghue, K., Patton, R., Phillips, T., Deluca, P., & Drummond, C. (2014). The effectiveness of electronic screening and brief intervention for reducing levels of alcohol consumption: A systematic review and meta-Analysis. *Journal of Medical Internet Research*, *16*(6).

Dunn, K. (2012). A qualitative investigation into the online counselling relationship: To meet or not to meet, that is the question. *Counselling and Psychotherapy Research*, *12*(4), 316–326.

Edwards, G., Gross, M. M., Keller, M., Moser, J., & Room, R. (1977). Alcohol related disabilities. *Who, Geneva*.

EÉk, N., Romberg, K., Siljeholm, O., Johansson, M., Andreasson, S., Lundgren, T., … Hammarberg, A. (2020). Efficacy of an Internet-Based Community Reinforcement and Family Training Program to Increase Treatment Engagement for AUD and to Improve Psychiatric Health for CSOs: A Randomized Controlled Trial. *Alcohol and Alcoholism*, 1–9.

Elison, S., Davies, G., & Ward, J. (2015). An outcomes evaluation of computerized treatment for problem drinking using Breaking Free Online. *Alcoholism Treatment Quarterly*, *33*(2), 185–196.

Epstein, J. A., Griffin, K. W., & Botvin, G. J. (2008). A social influence model of alcohol use for inner-city adolescents: Family drinking, perceived drinking norms, and perceived social benefits of drinking. *Journal of Studies on Alcohol and Drugs*, *69*(3), 397–405.

Erwin, B. L., & Slaton, R. M. (2014). Varenicline in the Treatment of Alcohol Use Disorders. *Annals of Pharmacotherapy*, *48*(11), 1445–1455.

Essex, H. N., White, I. R., Khadjesari, Z., Linke, S., McCambridge, J., Murray, E., … Godfrey, C. (2014). Quality of life among hazardous and harmful drinkers: EQ-5D over a 1-year follow-up period. *Quality of Life Research*, *23*(2), 735–745.

Eysenbach, G. (2005). The law of attrition. *Journal of Medical Internet Research*, *7*(1), e11.

Fals-Stewart, W., & Lam, W. K. K. (2010). Computer-Assisted Cognitive Rehabilitation for the Treatment of Patients With Substance Use Disorders: A Randomized Clinical Trial. *Experimental and Clinical Psychopharmacology*, *18*(1), 87–98.

Fan, A. Z., Chou, S. P., Zhang, H., Jung, J., & Grant, B. F. (2019). Prevalence and Correlates of Past-Year Recovery From DSM-5 Alcohol Use Disorder: Results From National Epidemiologic Survey on Alcohol and Related Conditions-III. *Alcoholism: Clinical and Experimental Research*, *43*(11), 2406–2420.

Farren, C. K., Milnes, J., Lambe, K., & Ahern, S. (2015). Computerised cognitive behavioural therapy for alcohol use disorder: a pilot randomised control trial. *Irish Journal of Psychological Medicine*, *32*(3), 237–246.

Ferri, M., Amato, L., Davoli, M., Abraha, I., & Cusi, C. (2006). Alcoholics Anonymous and other 12-step programmes for alcohol dependence. *Cochrane Database of Systematic Reviews*, (3), 8–9.

Field, M., Wiers, R. W., Christiansen, P., Fillmore, M. T., & Verster, J. C. (2010). Acute alcohol effects on inhibitory control and implicit cognition: Implications for loss of control over drinking. *Alcoholism: Clinical and Experimental Research*, *34*(8), 1346–1352.

Finfgeld-Connett, D., & Madsen, R. (2008). Web-based treatment of alcohol problems among rural women: Results of a randomized pilot investigation. *Journal of Psychosocial Nursing and Mental Health Services*, *46*(9), 46–53.

Fingarette, H. (1988). *Heavy drinking: The myth of alcoholism as a disease*. Univ of California Press.

Fink, A., Kwan, L., Osterweil, D., Van Draanen, J., Cooke, A., & Beck, J. C. (2016). Assessing the usability of web-based alcohol education for older adults: A feasibility study. *JMIR Research Protocols*, *5*(1), e11.

Finn, S. W., Bakshi, A.-S., & Andreasson, S. (2014). Alcohol Consumption, Dependence, and Treatment Barriers: Perceptions Among Nontreatment Seekers with Alcohol Dependence. *Substance use and Misuse*, *49*(6), 762–769.

Fletcher-Tomenius, L. J., & Vossler, A. (2009). Trust in online therapeutic relationships: The therapist's experience. *Counselling Psychology Review*, *24*(2), 24–33.

Flückiger, C., Del Re, A. C., Wampold, B. E., Horvath, A. O., Del, A. C., Wampold, B. E., & Horvath, A. O. (2018). The Alliance in Adult Psychotherapy: A Meta-Analytic Synthesis. *Psychotherapy*, *55*(4), 316–340.

Forsberg, L., Halldin, J., & Wennberg, P. (2003). Psychometric properties and factor structure of the readiness to change questionnaire. *Alcohol and Alcoholism*, *38*(3), 276–280.

Forsell, E., Isacsson, N., Blom, K., Jernelöv, S., Abdesslem, F. Ben, Lindefors, N., … Kaldo, V. (2020). Predicting treatment failure in regular care internet-delivered cognitive behavior therapy for depression and anxiety using only weekly symptom measures. *Journal of Consulting and Clinical Psychology*, *88*(4), 311–321.

Franck, J., & Jayaram-Lindström, N. (2013). Pharmacotherapy for alcohol dependence: Status of current treatments. *Current Opinion in Neurobiology*, *23*(4), 692–699.

Frost, M. C., Glass, J. E., Bradley, K. A., & Williams, E. C. (2020). Documented brief intervention associated with reduced linkage to specialty addictions treatment in a national sample of VA patients with unhealthy alcohol use with and without alcohol use disorders. *Addiction*, *115*(4), 668–678.

Furtwængler, N. A. F. F., & De Visser, R. O. (2013). Lack of international consensus in low-risk drinking guidelines. *Drug and Alcohol Review*, *32*(1), 11–18.

Gajecki, M., Andersson, C., Rosendahl, I., Sinadinovic, K., Fredriksson, M., & Berman, A. H. (2017). Skills Training via Smartphone App for University Students with Excessive Alcohol Consumption: a Randomized Controlled Trial. *International Journal of Behavioral Medicine*, *24*(5), 778–788. Gajecki, M., Berman, A. H., Sinadinovic, K., Rosendahl, I., & Andersson, C. (2014). Mobile phone brief intervention applications for risky alcohol use among university students: A randomized controlled study. *Addiction Science and Clinical Practice*, *9*(1).

Garnett, C. V., Crane, D., Brown, J., Kaner, E. F., Beyer, F. R., Muirhead, C. R., … Michie, S. (2018). Behavior change techniques used in digital behavior change interventions to reduce excessive alcohol consumption: A meta-regression. *Annals of Behavioral Medicine*, *52*(6).

Gaume, J., Bertholet, N., & Daeppen, J.-B. (2017). Readiness to change predicts drinking: findings from 12-month follow-up of alcohol use disorder outpatients. *Alcohol and Alcoholism*, *52*(1), 65–71.

GBD 2016 Alcohol Collaborators, M. G., Fullman, N., Hawley, C., Arian, N., Zimsen, S. R. M.,

Tymeson, H. D., … Gakidou, E. (2018). Alcohol use and burden for 195 countries and territories, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet (London, England)*, *392*(10152), 1015–1035.

Glass, J. E., Andréasson, S., Bradley, K. A., Finn, S. W., Williams, E. C., Bakshi, A. S., … Saitz, R. (2017). Rethinking alcohol interventions in health care: A thematic meeting of the International Network on Brief Interventions for Alcohol & Other Drugs (INEBRIA). *Addiction Science and Clinical Practice*, *12*(1), 1–16.

Goh, E. T., & Morgan, M. Y. (2017). Review article: pharmacotherapy for alcohol dependence – the why, the what and the wherefore. *Alimentary Pharmacology and Therapeutics*, *45*(7), 865–882.

González Suitt, K., Geraldo, P., Estay, M., & Franklin, C. (2019). Solution-Focused Brief Therapy for Individuals With Alcohol Use Disorders in Chile. *Research on Social Work Practice*, *29*(1), 19–35.

Gonzalez, V. M., & Dulin, P. L. (2015). Comparison of a smartphone app for alcohol use disorders with an internet-based intervention plus bibliotherapy: A pilot study. *Journal of Consulting and Clinical Psychology*, *83*(2), 335–345.

Grant, B. F. (1997). Barriers to alcoholism treatment: Reasons for not seeking treatment in a general population sample. *Journal of Studies on Alcohol*.

Grant, B. F., Goldstein, R. B., Saha, T. D., Patricia Chou, S., Jung, J., Zhang, H., … Hasin, D. S. (2015). Epidemiology of DSM-5 alcohol use disorder results from the national epidemiologic survey on alcohol and related conditions III. *JAMA Psychiatry*, *72*(8), 757–766.

Gunn, C., Mackus, M., Griffin, C., Munafò, M. R., & Adams, S. (2018). A systematic review of the next-day effects of heavy alcohol consumption on cognitive performance. *Addiction*, *113*(12), 2182–2193.

Gustafson, D. H., McTavish, F. M., Chih, M.-Y. Y., Atwood, A. K., Johnson, R. A., Boyle, M. G., … Shah, D. (2014). A smartphone application to support recovery from alcoholism a randomized clinical trial. *JAMA Psychiatry*, *71*(5), 566–572.

Guttormsson, U., & Gröndahl, M. (2017). *Trender i dryckesmönster: befolkningens självrapporterade alkoholvanor under 2000-talet (Trends in drinking patterns, in Swedish)*. Stockholm, Sweden: The Swedish Council for Information on Alcohol and Other Drugs (CAN).

Hawkins, J. D., Graham, J. W., Maguin, E., Abbott, R., Hill, K. G., & Catalano, R. F. (1997). Exploring the effects of age of alcohol use initiation and psychosocial risk factors on subsequent alcohol misuse. *Journal of Studies on Alcohol*, *58*(3), 280–290.

Heather, N. (2013). A radical but flawed proposal: Comments on Rehm et al. "defining substance use disorders: Dowe really need more than heavy use?" *Alcohol and Alcoholism*, *48*(6), 646–647.

Heather, N., Adamson, S. J., Raistrick, D., & Slegg, G. P. (2010). Initial preference for drinking goal in the treatment of alcohol problems: I. Baseline differences between abstinence and non-abstinence groups. *Alcohol & Alcoholism*, *45*(2), 128–135.

Heather, N., Best, D., Kawalek, A., Field, M., Lewis, M., Rotgers, F., … Heim, D. (2018). Challenging the brain disease model of addiction: European launch of the addiction theory network. *Addiction Research and Theory*, *26*(4), 249–255.

Hedges, Larry V. "Distribution theory for Glass's estimator of effect size and related estimators." *Journal of Educational Statistics* 6.2 (1981): 107-128.

Helander, A., Péter, O., & Zheng, Y. (2012). Monitoring of the alcohol biomarkers PEth, CDT and EtG/EtS in an outpatient treatment setting. *Alcohol and Alcoholism*, *47*(5), 552–557.

Herdman, M., Gudex, C., Lloyd, A., Janssen, M., Kind, P., Parkin, D., … Badia, X. (2011). Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Quality of Life Research*, *20*(10), 1727–1736.

Hesser, H. (2015). Modeling individual differences in randomized experiments using growth models: Recommendations for design, statistical analysis and reporting of results of internet interventions. *Internet Interventions*, *2*(2), 110–120.

Hester, R. K., & Delaney, H. D. (1997). Behavioral self-control program for windows: Results of a controlled clinical trial. *Journal of Consulting and Clinical Psychology*, *65*(4), 686–693.

Hester, R. K., Delaney, H. D., Campbell, W., & Handmaker, N. (2009). A web application for moderation training: Initial results of a randomized clinical trial. *Journal of Substance Abuse Treatment*, *37*(3), 266–276.

Hester, R. K., Lenberg, K. L., Campbell, W., & Delaney, H. D. (2013). Overcoming Addictions, a Web-Based Application, and SMART Recovery, an Online and In-Person Mutual Help Group for Problem Drinkers, Part 1: Three-Month Outcomes of a Randomized Controlled Trial. *Journal of Medical Internet Research*, *15*(7), e134.

Hester, R. K., & Miller, J. H. (2006). Computer-based tools for diagnosis and treatment of alcohol problems. *Alcohol Research & Health*.

Holländare, F., Andersson, G., & Engström, I. (2010). A comparison of psychometric properties between Internet and paper versions of two Depression instruments (BDI-II and MADRS-S) administered to clinic patients. *Journal of Medical Internet Research*, *12*(5), e49.

Holmes, M. V., Dale, C. E., Zuccolo, L., Silverwood, R. J., Guo, Y., Ye, Z., … Casas, J. P. (2014). Association between alcohol and cardiovascular disease: Mendelian randomisation analysis based on individual participant data. *BMJ (Online)*, *349*(July), 1–16.

Holst, A., Nejati, S., Björkelund, C., Eriksson, M. C. M., Hange, D., Kivi, M., … Petersson, E.-L. (2017). Patients' experiences of a computerised self-help program for treating depression – a qualitative study of Internet mediated cognitive behavioural therapy in primary care. *Scandinavian Journal of Primary Health Care*, *35*(1), 46–53.

Hyland, K., Hammarberg, A., Hedman-Lagerlöf, E., Johansson, M., & Andreasson, S. (2019). The efficacy of iCBT added to treatment as usual for alcohol-dependent patients in primary care: Study protocol for a randomized controlled trial. *Trials*, *20*(1), 1–8.

Imel, Z. E., Wampold, B. E., Miller, S. D., & Fleming, R. R. (2008). Distinctions Without a Difference: Direct Comparisons of Psychotherapies for Alcohol Use Disorders. *Psychology of Addictive Behaviours*, *22*(4), 533–543.

Institute of Medicine. (1990). *Broadening the Base of Treatment for Alcohol Problems*. Washington, D.C.: National Academies Press.

Internetstiftelsen. (2019). *Svenskarna och Internet. Stiftelsen för internetinfrastruktur*. Retrieved from https://svenskarnaochinternet.se/english/

Jackson, C., Henriksen, L., & Dickinson, D. (1999). Alcohol-specific socialization, parenting behaviors and alcohol use by children. *Journal of Studies on Alcohol*, *60*(3), 362–367.

Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, *59*(1), 12–19.

Johansson, M., Sinadinovic, K., Hammarberg, A., Sundstrom, C., Hermansson, U., Andreasson, S., … Berman, A. H. (2017). Web-Based Self-Help for Problematic Alcohol Use: a Large Naturalistic Study. *International Journal of Behavioral Medicine*, *24*(5), 749–759.

Johansson, R., Sjöberg, E., Sjögren, M., Johnsson, E., Carlbring, P., Andersson, T., … Andersson, G. (2012). Tailored vs. Standardized internet-based cognitive behavior therapy for depression and comorbid symptoms: A randomized controlled trial. *PLoS ONE*, *7*(5), 1–9.

Kadden, R. (1995). *Cognitive-behavioral coping skills therapy manual: A clinical research guide for therapists treating individuals with alcohol abuse and dependence*. Public Health Service, National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism.

Kadden, R. M., & Litt, M. D. (2011). The role of self-efficacy in the treatment of substance use disorders. *Addictive Behaviors*, *36*(12), 1120–1126.

Kallmen, H., Wennberg, P., Ramstedt, M., Hallgren, M., Källmén, H., Wennberg, P., … Hallgren, M. (2015). Changes in alcohol consumption between 2009 and 2014 assessed with the AUDIT. *Scandinavian Journal of Public Health*, *43*(4), 381–384.

Kaner, E. F., Beyer, F. R., Garnett, C., Crane, D., Brown, J., Muirhead, C., … Michie, S. (2017). Personalised digital interventions for reducing hazardous and harmful alcohol consumption in community-dwelling populations. *Cochrane Database of Systematic Reviews*, (9).

Kaner, E. F., Beyer, F. R., Muirhead, C., Campbell, F., Pienaar, E. D., Bertholet, N., … Burnand, B. (2018, February 24). Effectiveness of brief alcohol interventions in primary care populations. *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

Karriker-Jaffe, K. J., Greenfield, T. K., & Kaplan, L. M. (2017). Distress and alcohol-related harms from intimates, friends, and strangers. *Journal of Substance Use*, *22*(4), 434–441.

Kay-Lambkin, F. J., Baker, A. L., Kelly, B. J., & Lewin, T. J. (2012). It's worth a try: The treatment experiences of rural and Urban participants in a randomized controlled trial of computerized psychological treatment for comorbid depression and alcohol/other drug use. *Journal of Dual Diagnosis*, *8*(4), 262–276.

Kay-Lambkin, F. J., Baker, A. L., Kelly, B., & Lewin, T. J. (2011). Clinician-assisted computerised versus therapist-delivered treatment for depressive and addictive disorders: A randomised controlled trial. *Medical Journal of Australia*, *195*(3 SUPPL.).

Kay-Lambkin, F. J., Baker, A. L., Kelly, B., & Lewin, T. J. (2011). Clinician-assisted computerised versus therapist-delivered treatment for depressive and addictive disorders: a randomised controlled trial. *Medical Journal of Australia*, *195*(S3), S44–S50.

Kay-Lambkin, F. J., Baker, A. L., Lewin, T. J., Carr, V. J., Kay-Lambkin, F. J., Baker, A. L., … Carr, V. J. (2009). Computer-based psychological treatment for comorbid depression and problematic alcohol and/or cannabis use: A randomized controlled trial of clinical efficacy. *Addiction*, *104*(3), 378–388.

Kazemi, D. M., Cochran, A. R., Kelly, J. F., Cornelius, J. B., & Belk, C. (2014). Integrating mHealth mobile applications to reduce high risk drinking among underage students. *Health Education Journal*, *73*(3), 262–273.

Kelly, J. F., Humphreys, K., & Ferri, M. (2020). Alcoholics Anonymous and other 12-step programs for alcohol use disorder. *The Cochrane Database of Systematic Reviews*, *3*, CD012880.

Kelly, J. F., & Westerhoff, C. M. (2010). Does it matter how we refer to individuals with substance-related conditions? A randomized study of two commonly used terms. *International Journal of Drug Policy*, *21*(3), 202–207.

Khadjesari, Z., Stevenson, F., Godfrey, C., & Murray, E. (2015). Negotiating the "grey area between normal social drinking and being a smelly tramp": A qualitative study of people searching for help online to reduce their drinking. *Health Expectations*, *18*(6), 2011–2020.

Khantzian, E. J. (1985). The self medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *American Journal of Psychiatry*, *142*(11), 1259–1264.

Kiluk, B. D., Devore, K. A., Buck, M. B., Nich, C., Frankforter, T. L., LaPaglia, D. M., … Carroll, K. M. (2016). Randomized Trial of Computerized Cognitive Behavioral Therapy for Alcohol Use Disorders: Efficacy as a Virtual Stand-Alone and Treatment Add-On Compared with Standard Outpatient Treatment. *Alcoholism: Clinical and Experimental Research*, *40*(9), 1991–2000.

Kiluk, B. D., Nich, C., Babuscio, T., & Carroll, K. M. (2010). Quality versus quantity: Acquisition of coping skills following computerized cognitive-behavioral therapy for substance use disorders. *Addiction*, *105*(12), 2120–2127.

Kiluk, B. D., Ray, L. A., Walthers, J., Bernstein, M., Tonigan, J. S., & Magill, M. (2019). Technology-Delivered Cognitive-Behavioral Interventions for Alcohol Use: A Meta-Analysis. *Alcoholism: Clinical and Experimental Research*, *43*(11), 2285–2295.

Klein, A. A., & Anker, J. J. (2013). Computer-based recovery support for patients receiving residential treatment for alcohol/drug dependence: Relationship between program use and outcomes. *Telemedicine and E-Health*, *19*(2), 104–109.

Klein, A. A., Slaymaker, V. J., Dugosh, K. L., & McKay, J. R. (2012). Computerized continuing care support for alcohol and drug dependence: A preliminary analysis of usage and outcomes.

Journal of Substance Abuse Treatment, *42*(1), 25–34.

Knowles, S. E., Toms, G., Sanders, C., Bee, P., Lovell, K., Rennick-Egglestone, S., … Bower, P. (2014). Qualitative meta-synthesis of user experience of computerised therapy for depression and anxiety. *PLoS ONE*, *9*(1).

Kohn, R., Saxena, S., Levav, I., & Saraceno, B. (2004). The treatment gap in mental health care. *Bulletin of the World Health Organization*, *82*, 858–866.

Koob, G. F. (2014). Neurocircuitry of alcohol addiction: Synthesis from animal models. In *Handbook of Clinical Neurology* (1st ed., Vol. 125, pp. 33–54). Elsevier B.V.

Koski-Jännes, A., & Cunningham, J. (2001). Interest in different forms of self-help in a general population sample of drinkers. *Addictive Behaviors*, *26*(1), 91–99.

Kramer, J., Riper, H., Lemmers, L., Conijn, B., van Straten, A., & Smit, F. (2009). Television-supported self-help for problem drinkers: a randomized pragmatic trial. *Addictive Behaviors*, *34*(5), 451–457.

Kreuter, M. W., Strecher, V. J., & Glassman, B. (1999). One size does not fit all: The case for tailoring print materials. *Annals of Behavioral Medicine*, *21*(4), 276–283.

Kypri, K., Sitharthan, T., Cunningham, J. A., Kavanagh, D. J., & Dean, J. I. (2005). Innovative approaches to intervention for problem drinking. *Current Opinion in Psychiatry*, *18*(3), 229–234.

Lewis, M. (2018). Brain change in addiction as learning, not disease. *New England Journal of Medicine*.

Li, D., Zhao, H., & Gelernter, J. (2012). Strong protective effect of the aldehyde dehydrogenase gene (ALDH2) 504lys (*2) allele against alcoholism and alcohol-induced medical diseases in Asians. *Human Genetics*, *131*(5), 725–737.

Li, T. K., Hewitt, B. G., & Grant, B. F. (2007). The Alcohol Dependence Syndrome, 30 years later: A commentary: The 2006 H. David Archibald Lecture. *Addiction*, *102*(10), 1522–1530.

Lindner, P., Siljeholm, O., Johansson, M., Forster, M., Andreasson, S., & Hammarberg, A. (2018). Combining online Community Reinforcement and Family Training (CRAFT) with a parent-training programme for parents with partners suffering from alcohol use disorder: Study protocol for a randomised controlled trial. *BMJ Open*, *8*(8), e020879.

Lindström, D., Sundberg-Petersson, I., Adami, J., & Tönnesen, H. (2010). Disappointment and drop-out rate after being allocated to control group in a smoking cessation trial. *Contemporary Clinical Trials*, *31*(1), 22–26.

Linke, S., McCambridge, J., Khadjesari, Z., Wallace, P., & Murray, E. (2008). Development of a psychologically enhanced interactive online intervention for hazardous drinking. *Alcohol and Alcoholism (Oxford, Oxfordshire)*, *43*(6), 669–674.

Linke, S., Murray, E., Butler, C., & Wallace, P. (2007). Internet-based interactive health intervention for the promotion of sensible drinking: Patterns of use and potential impact on members of the general public. *Journal of Medical Internet Research*, *9*(2).

Livingston, M., Wilkinson, C., & Laslett, A.-M. (2010). Impact of heavy drinkers on others' health and well-being. *Journal of Studies on Alcohol and Drugs*, *71*(5), 778–785.

Magill, M., Apodaca, T. R., Borsari, B., Gaume, J., Hoadley, A., Gordon, R. E. F., … Moyers, T. (2018). A meta-Analysis of motivational interviewing process: Technical, relational, and conditional process models of change. *Journal of Consulting and Clinical Psychology*, *86*(2), 140–157.

Magill, M., Kiluk, B. D., McCrady, B. S., Tonigan, J. S., & Longabaugh, R. (2015). Active Ingredients of Treatment and Client Mechanisms of Change in Behavioral Treatments for Alcohol Use Disorders: Progress 10Years Later. *Alocoholism – Clinical and experimental research*, *39*(10), 1852–1862.

Magill, M., & Ray, L. A. (2009). Cognitive-Behavioral Treatment With Adult Alcohol and Illicit Drug Users: A Meta-Analysis of Randomized Controlled Trials. *Journal of Studies on Alcohol and Drugs*, *70*(4), 516–527.

Magill, M., Ray, L., Kiluk, B., Hoadley, A., Bernstein, M., Scott Tonigan, J., & Carroll, K. (2019). A meta-analysis of cognitive-behavioral therapy for alcohol or other drug use disorders: Treatment efficacy by contrast condition. *Journal of Consulting and Clinical Psychology*, *87*(12), 1093–1105.

Maisel, N. C., Blodgett, J. C., Wilbourne, P. L., Humphreys, K., & Finney, J. W. (2013). Meta-analysis of naltrexone and acamprosate for treating alcohol use disorders: When are these medications most helpful? *Addiction*, *108*(2), 275–293.

Marlatt, G. A., & Donovan, D. M. (2005). *Relapse prevention: Maintenance strategies in the treatment of addictive behaviors*. Guilford press.

Marlatt, G. A., & Gordon, J. R. (1985). Relapse prevention: A self-control strategy for the maintenance of behavior change. *New York: Guilford*, 85–101.

Mathiesen, E. F., Nome, S., Eisemann, M., & Richter, J. (2012). Drinking patterns, psychological distress and quality of life in a Norwegian general population-based sample. *Quality of Life Research*, *21*(9), 1527–1536.

McAlaney, J., & McMahon, J. (2007). Normative beliefs, misperceptions, and heavy episodic drinking in a British student sample. *Journal of Studies on Alcohol and Drugs*, *68*(3), 385–392.

McCambridge, J., & Cunningham, J. A. (2014). The early history of ideas on brief interventions for alcohol. *Addiction*, *109*(4), 538–546.

McCambridge, J., & Kypri, K. (2011). Can simply answering research questions change behaviour? Systematic review and meta analyses of brief alcohol intervention trials. *PLoS ONE*, *6*(10).

McCambridge, J., Kypri, K., & McElduff, P. (2014). Regression to the mean and alcohol consumption: A cohort study exploring implications for the interpretation of change in control groups in brief intervention trials. *Drug and Alcohol Dependence*, *135*(1), 156–159.

McCambridge, J., & Saitz, R. (2017). Rethinking brief interventions for alcohol in general practice. *Bmj*, *356*, j116.

McGeary, J. E., Meadows, S. P., Amir, N., & Gibb, B. E. (2014). Computer-delivered, home-based, attentional retraining reduces drinking behavior in heavy drinkers. *Psychology of Addictive Behaviors*, *28*(2), 559–562.

Meier, P. S., Barrowclough, C., & Donmall, M. C. (2005). The role of the therapeutic alliance in the treatment of substance misuse: a critical review of the literature. *Addiction*, *100*(3), 304–316.

Meyers, R. J., & Smith, J. E. (1995). *Clinical guide to alcohol treatment: The community reinforcement approach*. Guilford Press.

Michie, S., Whittington, C., Hamoudi, Z., Zarnani, F., Tober, G., & West, R. (2012). Identification of behaviour change techniques to reduce excessive alcohol consumption. *Addiction*, *107*(8), 1431–1440.

Miller, S. D., Hubble, M. A., Chow, D., & Seidel, J. (2015). Beyond measures and monitoring: Realizing the potential of feedback-informed treatment. *Psychotherapy*, *52*(4), 449–457.

Miller, W., & Munoz, R. (1982). How to control your drinking: A practical guide to responsible drinking. *Revised Edition, University of New Mexico Press, Albuquerque, New Mexico*.

Miller, W. R. (1995). *Motivational enhancement therapy manual: A clinical research guide for therapists treating individuals with alcohol abuse and dependence*. DIANE Publishing.

Miller, W. R., & Kurtz, E. (1994). Models of alcoholism used in treatment: contrasting AA and other perspectives with which it is often confused. *Journal of Studies on Alcohol*, *55*(2), 159–166.

Miller, W. R., & Moyers, T. B. (2015). The forest and the trees: Relational and specific factors in addiction treatment. *Addiction*, *110*(3), 401–413.

Miller, W. R., & Rollnick, S. (2012). *Motivational interviewing: Helping people change*.

Miller, W. R., & Rose, G. S. (2009). Toward a Theory of Motivational Interviewing. *American Psychologist*, *64*(6), 527–537.

Miller, W. R., Sovereign, R. G., & Krege, B. (1988). Motivational Interviewing with Problem Drinkers:

II. The Drinker's Check-up as a Preventive Intervention. *Behavioural Psychotherapy*, *16*(4), 251–268.

Milward, J., Drummond, C., Fincham-Campbell, S., & Deluca, P. (2018). What makes online substance-use interventions engaging? A systematic review and narrative synthesis. *Digital Health*, *4*, 205520761774335.

Minozzi, S., Saulle, R., & Rösner, S. (2018). Baclofen for alcohol use disorder. *Cochrane Database of Systematic Reviews*, *2018*(11).

Monti, P. M. (2002). *Treating alcohol dependence: A coping skills training guide*. Guilford Press.

Moreira, M. T., Smith, L. A., & Foxcroft, D. (2009). Social norms interventions to reduce alcohol misuse in University or College students. *Cochrane Database of Systematic Reviews*.

Moyers, T. B. (2014). The Relationship in Motivational Interviewing How is MI Different From Other Treatment Approaches? *Psychotherapy*, *51*(3), 358–363.

Moyers, T. B., Martin, T., Manuel, J. K., Hendrickson, S. M. L., & Miller, W. R. (2005). Assessing competence in the use of motivational interviewing. *Journal of Substance Abuse Treatment*, *28*(1), 19–26.

Muench, F., van Stolk-Cooke, K., Kuerbis, A., Stadler, G., Baumel, A., Shao, S., … Morgenstern, J. (2017). A randomized controlled pilot trial of different mobile messaging interventions for problem drinking compared to weekly drink tracking. *PloS One*, *12*(2), e0167900.

Munder, T., Wilmers, F., Leonhart, R., Linster, H. W., & Barth, J. (2010). Working alliance inventory-short revised (WAI-SR): Psychometric properties in outpatients and inpatients. *Clinical Psychology and Psychotherapy*, *17*(3), 231–239.

Murray, C. J. L., Vos, T., Lozano, R., Naghavi, M., Flaxman, A. D., Michaud, C., … Lopez, A. D. (2012). Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: A systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*, *380*(9859), 2197–2223.

Murray, E., White, I. R., Varagunam, M., Godfrey, C., Khadjesari, Z., & McCambridge, J. (2013). Attrition revisited: Adherence and retention in a web-based alcohol trial. *Journal of Medical Internet Research*, *15*(8), e162.

Niaura, R. (2000). Cognitive social learning and related perspectives on drug craving. *Addiction*, *95*(8), 155–163.

Nilsen, P., McCambridge, J., Karlsson, N., & Bendtsen, P. (2011). Brief interventions in routine health care: A population-based study of conversations about alcohol in Sweden. *Addiction*, *106*(10), 1748–1756.

Noar, S. M., Benac, C. N., & Harris, M. S. (2007). Does Tailoring Matter? Meta-Analytic Review of Tailored Print Health Behavior Change Interventions. *Psychological Bulletin*, *133*(4), 673–693.

Norström, T., & Ramstedt, M. (2005). Mortality and population drinking: A review of the literature. *Drug and Alcohol Review*, *24*(6), 537–547.

Norström, T., & Ramstedt, M. (2018). The link between per capita alcohol consumption and alcohol-related harm in Sweden, 1987–2015. *Journal of Studies on Alcohol and Drugs*, *79*(4), 578–584.

Nyhuis, P. W., Niederhofer, E., Scherbaum, N., Schifano, F., Bonnet, U., Dembski, N., … Tenbergen, M. (2018). Effectiveness of Psychoanalytic-Interactional Group Therapy vs. Behavioral Group Therapy in Routine Outpatient Treatment of Alcohol-Dependent Patients. *Substance Use and Misuse*, *53*(3), 426–431.

O'Brien, C. (2011). Addiction and dependence in DSM-V. *Addiction*, *106*(5), 866–867.

O'Farrell, T. J., & Fals-Stewart, W. (2003, January). Alcohol abuse. *Journal of Marital and Family Therapy*. Wiley/Blackwell (10.1111).

Onken, L. S., Blaine, J. D., & Boren, J. J. (Eds.). (1993). *Behavioral treatments for drug abuse and dependence*. US. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute on Drug Abuse.

Orford, J. (1973). A comparison of alcoholics whose drinking is totally uncontrolled and those whose drinking is mainly controlled. *Behaviour Research and Therapy*, *11*(4), 565–576.

Orford, J. (2005). Effectiveness of treatment for alcohol problems: Findings of the randomised UK alcohol treatment trial (UKATT). *British Medical Journal*, *331*(7516), 541–544.

Osilla, K. C., Paddock, S. M., Leininger, T. J., D'Amico, E. J., Ewing, B. A., & Watkins, K. E. (2015). A pilot study comparing in-person and web-based motivational interviewing among adults with a first-time DUI offense. *Addiction Science & Clinical Practice*, *10*(1), 18.

Ostafin, B. D., Marlatt, G. A., & Greenwald, A. G. (2008). Drinking without thinking: An implicit measure of alcohol motivation predicts failure to control alcohol use. *Behaviour Research and Therapy*, *46*(11), 1210–1219.

Palpacuer, C., Laviolle, B., Boussageon, R., Reymann, J. M., Bellissant, E., & Naudet, F. (2015). Risks and Benefits of Nalmefene in the Treatment of Adult Alcohol Dependence: A Systematic Literature Review and Meta-Analysis of Published and Unpublished Double-Blind Randomized Controlled Trials. *PLoS Medicine*, *12*(12), 1–17.

Peele, S., & Brodsky, A. (2000). Exploring psychological benefits associated with moderate alcohol use: A necessary corrective to assessments of drinking outcomes? *Drug and Alcohol Dependence*, *60*(3), 221–247.

Pemberton, M. R., Williams, J., Herman-Stahl, M., Calvin, S. L., Bradshaw, M. R., Bray, R. M., … Mitchell, G. M. (2011). Evaluation of two web-based alcohol interventions in the u.s. military. *Journal of Studies on Alcohol and Drugs*, *72*(3), 480–489.

Pierce, M., Sutterland, A., Beraha, E. M., Morley, K., & van den Brink, W. (2018). Efficacy, tolerability, and safety of low-dose and high-dose baclofen in the treatment of alcohol dependence: A systematic review and meta-analysis. *European Neuropsychopharmacology*, *28*(7), 795–806.

Pihlaja, S., Stenberg, J. H., Joutsenniemi, K., Mehik, H., Ritola, V., & Joffe, G. (2018). Therapeutic alliance in guided internet therapy programs for depression and anxiety disorders – A systematic review. *Internet Interventions*. Elsevier.

Postel, M. G., De Haan, H. A., & De Jong, C. A. J. (2010). Evaluation of an e-therapy program for problem drinkers: a pilot study. *Substance Use & Misuse*, *45*(12), 2059–2075.

Postel, M. G., De Haan, H. A., Ter Huurne, E. D., Becker, E. S., & De Jong, C. A. J. (2010). Effectiveness of a web-based intervention for problem drinkers and reasons for dropout: Randomized controlled trial. *Journal of Medical Internet Research*, *12*(4), 11–22.

Postel, M. G., de Haan, H. A., Ter Huurne, E. D., van der Palen, J., Becker, E. S., & de Jong, C. A. J. (2011). Attrition in web-based treatment for problem drinkers. *Journal of Medical Internet Research*, *13*(4), e117.

Powers, M. B., Vedel, E., & Emmelkamp, P. M. G. (2008, July 1). Behavioral couples therapy (BCT) for alcohol and drug use disorders: A meta-analysis. *Clinical Psychology Review*. Pergamon.

Prendergast, M. L., Podus, D., Chang, E., & Urada, D. (2002). The effectiveness of drug abuse treatment: a meta-analysis of comparison group studies. *Drug and Alcohol Dependence*, *67*(1), 53–72.

Probst, C., Manthey, J., Martinez, A., & Rehm, J. (2015). Alcohol use disorder severity and reported reasons not to seek treatment: a cross-sectional study in European primary care practices. *Substance Abuse Treatment, Prevention, and Policy*, *10*(1), 32.

Prochaska, J. O., & DiClemente, C. C. (1986). Toward a comprehensive model of change. In *Treating addictive behaviors* (pp. 3–27). Springer.

Pucci, M., Micioni Di Bonaventura, M. V., Wille-Bille, A., Fernández, M. S., Maccarrone, M., Pautassi, R. M., … D'Addario, C. (2019). Environmental stressors and alcoholism development: Focus on molecular targets and their epigenetic regulation. *Neuroscience and Biobehavioral Reviews*, *106*(June 2018), 165–181.

Ramstedt, M., Sundin, E., Moan, I. S., Storvoll, E. E., Lund, I. O., Bloomfield, K., … Tigerstedt, C. (2015). Harm experienced from the heavy drinking of family and friends in the general

population: A comparative study of six Northern European Countries. *Substance Abuse: Research and Treatment*, *9*, 107–118.

Raninen, J., Elgán, T. H., Sundin, E., & Ramstedt, M. (2016). Prevalence of children whose parents have a substance use disorder: Findings from a Swedish general population survey. *Scandinavian Journal of Public Health*, *44*(1), 14–17.

Raninen, J., Leifman, H., & Ramstedt, M. (2013). Who Is Not Drinking Less in Sweden? An Analysis of the Decline in Consumption for the Period 2004-2011. *Alcohol and Alcoholism*, *48*(5), 592–597.

Rehm, J., Marmet, S., Anderson, P., Gual, A., Kraus, L., Nutt, D. J., … Gmel, G. (2013). Defining substance use disorders: Do we really need more than heavy use? *Alcohol and Alcoholism*, *48*(6), 633–640.

Rehm, J., Shield, K. D., Gmel, G., Rehm, M. X., & Frick, U. (2013). Modeling the impact of alcohol dependence on mortality burden and the effect of available treatment interventions in the European Union. *European Neuropsychopharmacology*, *23*(2), 89–97.

Rehm, J. T., Gmel, G. E., Gmel, G., Hasan, O. S. M., Imtiaz, S., Popova, S., … Shuper, P. A. (2017). The relationship between different dimensions of alcohol use and the burden of disease—an update. *Addiction*.

Rehm, J. T., Mathers, C., Popova, S., Thavorncharoensap, M., Teerawattananon, Y., & Patra, J. (2009). Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *The Lancet*.

Rehm, J. T., Room, R., & Taylor, B. (2008). Method for moderation: Measuring lifetime risk of alcohol-attributable mortality as a basis for drinking guidelines. *International Journal of Methods in Psychiatric Research*, *17*(3), 141–151.

Rehm, J, Manthey, J., Struzzo, P., Gual, A., & Wojnar, M. (2015). Who receives treatment for alcohol use disorders in the European Union? A cross-sectional representative study in primary and specialized health care. *European Psychiatry*, *30*(8), 885–893.

Rehm, Jürgen, Allamani, A., Elekes, Z., Jakubczyk, A., Manthey, J., Probst, C., … Wojnar, M. (2015). Alcohol dependence and treatment utilization in Europe - A representative cross-sectional study in primary care. *BMC Family Practice*, *16*(1), 90.

Rehm, Jürgen, Baliunas, D., Borges, G. L. G., Graham, K., Irving, H., Kehoe, T., … Taylor, B. (2010). The relation between different dimensions of alcohol consumption and burden of disease: An overview. *Addiction*, *105*(5), 817–843.

Rehm, Jürgen, Heilig, M., & Gual, A. (2019). ICD-11 for Alcohol Use Disorders: Not a Convincing Answer to the Challenges. *Alcoholism: Clinical and Experimental Research*, *43*(11), 2296–2300.

Riper, H., Hoogendoorn, A., Cuijpers, P., Karyotaki, E., Boumparis, N., Mira, A., … Smit, J. H. (2018). Effectiveness and treatment moderators of internet interventions for adult problem drinking: An individual patient data meta-analysis of 19 randomised controlled trials. *PLoS Medicine*, *15*(12), e1002714.

Riper, H., Kramer, J., Conijn, B., Smit, F., Schippers, G., & Cuijpers, P. (2009). Translating effective web-based self-help for problem drinking into the real world. *Alcoholism: Clinical and Experimental Research*, *33*(8), 1401–1408.

Riper, H., Kramer, J., Keuken, M., Smit, F., Schippers, G., & Cuijpers, P. (2008). Predicting successful treatment outcome of web-based self-help for problem drinkers: Secondary analysis from a randomized controlled trial. *Journal of Medical Internet Research*, *10*(4).

Riper, H., Kramer, J., Smit, F., Conijn, B., Schippers, G., & Cuijpers, P. (2007). Web-based self-help for problem drinkers: A pragmatic randomized trial. *Addiction*, *103*(2), 218–227.

Riper, H., Spek, V., Boon, B., Conijn, B., Kramer, J., Martin-Abello, K., & Smit, F. (2011). Effectiveness of E-Self-help interventions for curbing adult problem drinking: A meta-analysis. *Journal of Medical Internet Research*, *13*(2), e42.

Riper, H., van Straten, A., Keuken, M., Smit, F., Schippers, G., & Cuijpers, P. (2009). Curbing Problem

Drinking with Personalized-Feedback Interventions. A Meta-Analysis. *American Journal of Preventive Medicine*. , 36(3), 247-255.

Ritterband, L. M., & Thorndike, F. (2006). Internet interventions or patient education web sites? *Journal of Medical Internet Research*, *8*(3), e18.

Roesner, S., Hackl-Herrwerth, A., Leucht, S., Lehert, P., Vecchi, S., Soyka, M., … Higley, A. E. (2010). Acamprosate for alcohol dependence. *Cochrane Database of Systematic Reviews*, (9), 385–389.

Rogers, C. R. (1957). The necessary and sufficient conditions of therapeutic personality change. *Journal of Consulting Psychology*, *21*(2), 95–103.

Rohsenow, D. J., Childress, A. R., Monti, P. M., Niaura, R. S., & Abrams, D. B. (1990). Cue reactivity in addictive behaviors: Theoretical and treatment implications. *International Journal of the Addictions*, *25*(7-8 A), 957–993.

Rollnick, S., Heather, N., Gold, R., & Hall, W. (1992). Development of a short "readiness to change" questionnaire for use in brief, opportunistic interventions among excessive drinkers. (U. Hapke, A. Erfurth, T. Müller-Thomsen & U. John, 1992, Übers.). *British Journal of Addiction*, *87*(5), 743–754.

Roozen, H. G., Boulogne, J. J., Van Tulder, M. W., Van Den Brink, W., De Jong, C. A. J., & Kerkhof, A. J. F. M. (2004). A systematic review of the effectiveness of the community reinforcement approach in alcohol, cocaine and opioid addiction. *Drug and Alcohol Dependence*.

Rose, G. (1981). Strategy of prevention: lessons from cardiovascular disease. *British Medical Journal (Clinical Research Ed.)*, *282*(6279), 1847.

Rösner, S., Hackl-Herrwerth, A., Leucht, S., Vecchi, S., Srisurapanont, M., & Soyka, M. (2010). Opioid antagonists for alcohol dependence. *Cochrane Database of Systematic Reviews*, (12).

Rossow, I., & Romelsjö, A. (2006). The extent of the "prevention paradox" in alcohol problems as a function of population drinking patterns. *Addiction*, *101*(1), 84–90.

Rozental, A., Boettcher, J., Andersson, G., Schmidt, B., & Carlbring, P. (2015). Negative Effects of Internet Interventions: A Qualitative Content Analysis of Patients' Experiences with Treatments Delivered Online. *Cognitive Behaviour Therapy*, *44*(3), 223–236.

Rueger, S. Y., Trela, C. J., Palmeri, M., & King, A. C. (2012). Self-administered web-based timeline followback procedure for drinking and smoking behaviors in young adults. *Journal of Studies on Alcohol and Drugs*, *73*(5), 829–833.

Ryan, R. M., Plant, R. W., & O'Malley, S. (1995). Initial motivations for alcohol treatment: Relations with patient characteristics, treatment involvement, and dropout. *Addictive Behaviors*, *20*(3), 279–297.

Saitz, R. (2010). Alcohol screening and brief intervention in primary care: Absence of evidence for efficacy in people with dependence or very heavy drinking. *Drug and Alcohol Review*, *29*(6), 631–640.

Saitz, R. (2016). International Statement Recommending Against the Use of Terminology That Can Stigmatize People. *Journal of Addiction Medicine*, *10*(1), 1–2.

Sanchez-Craig, M. (2015). *Saying when: How to quit drinking or cut down*. Centre for Addiction and Mental Health.

Saunders, J. B., Aasland, O. G., Amundsen, A., & Grant, M. (1993). Alcohol consumption and related problems among primary health care patients: WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption—I. *Addiction*, *88*(3), 349–362.

Saunders, J. B., Aasland, O. G., Babor, T. F., De La Fuente, J. R., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption-II. *Addiction*, *88*(6), 791–804.

Saunders, J. B., Degenhardt, L., Reed, G. M., & Poznyak, V. (2019). Alcohol Use Disorders in ICD-11: Past, Present, and Future. *Alcoholism: Clinical and Experimental Research*, *43*(8), 1617–1631.

Saunders, S. M., Zygowicz, K. M., & D'Angelo, B. R. (2006). Person-related and treatment-related

barriers to alcohol treatment. *Journal of Substance Abuse Treatment*, *30*(3), 261–270.

Schomerus, G., Corrigan, P. W., Klauer, T., Kuwert, P., Freyberger, H. J., & Lucht, M. (2011). Self-stigma in alcohol dependence: consequences for drinking-refusal self-efficacy. *Drug and Alcohol Dependence*, *114*(1), 12–17.

Schomerus, G., Lucht, M., Holzinger, A., Matschinger, H., Carta, M. G., & Angermeyer, M. C. (2011, March 1). The stigma of alcohol dependence compared with other mental disorders: A review of population studies. *Alcohol and Alcoholism*. Narnia.

Schomerus, G., Matschinger, H., & Angermeyer, M. C. (2014). Attitudes towards alcohol dependence and affected individuals: persistence of negative stereotypes and illness beliefs between 1990 and 2011. *European Addiction Research*, *20*(6), 293–299.

Schuler, M. S., Puttaiah, S., Mojtabai, R., & Crum, R. M. (2015). Perceived barriers to treatment for alcohol problems: A latent class analysis. *Psychiatric Services*, *66*(11), 1221–1228

Schulz, D. N., Candel, M. J. J. M., Kremers, S. P. J., Reinwand, D. A., Jander, A., & de Vries, H. (2013). Effects of a Web-based tailored intervention to reduce alcohol consumption in adults: randomized controlled trial. *Journal of Medical Internet Research*, *15*(9), e206.

Sinadinovic, K. (2012). *Reaching out - Internet-Based Self-Assessment of Problematic Substance Use With Personalized Feedback*.

Sinadinovic, K., Berman, A. H., Hasson, D., & Wennberg, P. (2010). Internet-based assessment and self-monitoring of problematic alcohol and drug use. *Addictive Behaviors*, *35*(5), 464–470.

Sinadinovic, K., Johansson, M., Johansson, A.-S., Lundqvist, T., Lindner, P., & Hermansson, U. (2019). Guided web-based treatment program for reducing cannabis use: a randomized controlled trial. *Addiction science & clinical practice*, *15*(1), 1-13.

Sinadinovic, K., Wennberg, P., & Berman, A. H. (2011). Population screening of risky alcohol and drug use via Internet and Interactive Voice Response (IVR): A feasibility and psychometric study in a random sample. *Drug and Alcohol Dependence*, *114*(1), 55–60.

Sinadinovic, K., Wennberg, P., Johansson, M., & Berman, A. H. (2014). Targeting individuals with problematic alcohol use via web-based cognitive-behavioral self-help modules, personalized screening feedback or assessment only: A randomized controlled trial. *European Addiction Research*, *20*(6), 305–318.

Sinclair, J. M. A., Chambers, S. E., & Manson, C. C. (2017). Internet support for dealing with problematic alcohol use: A survey of the soberistas online community. *Alcohol and Alcoholism*, *52*(2), 220–226.

Sjölund, T. (2007). Effektutvärdering av Alkoholprofilen – ett internetbaserat bedömningsinstrument med personlig återkoppling, (29).

Skevington, S. M., Lotfy, M., & O'Connell, K. A. (2004). The World Health Organization's WHOQOL-BREF quality of life assessment: Psychometric properties and results of the international field trial a Report from the WHOQOL Group. *Quality of Life Research*, *13*(2), 299–310.

Skinner, M. D., Lahmek, P., Pham, H., & Aubin, H. J. (2014). Disulfiram efficacy in the treatment of alcohol dependence: A meta-analysis. *PLoS ONE*, *9*(2).

Skog, O. J. (2006). Alcohol and the so-called prevention paradox: How does it look today? *Addiction*, *101*(2), 155–158.

Sobell, L. C., Brown, J., Leo, G. I., & Sobell, M. B. (1996). The reliability of the Alcohol Timeline Followback when administered by telephone and by computer. *Drug and Alcohol Dependence*, *42*(1), 49–54.

Sobell, L. C., Cunningham, J. A., & Sobell, M. B. (1996). Recovery from alcohol problems with and without treatment: Prevalence in two population surveys. *American Journal of Public Health*, *86*(7), 966–972.

Sobell, L. C., Sobell, M. B., Toneatto, T., & Leo, G. I. (1993). What triggers the resolution of alcohol problems without treatment? *Alcoholism: Clinical and Experimental Research*, *17*(2), 217–224.

Sobell, L., & Sobell, M. (1992). Timeline follow-back: A technique for assessing self-reported alcohol consumption. In *Measuring Alcohol Consumption Psychosocial and Biochemical Methods* (pp. 41–72).

Sobell, M. B., & Sobell, L. C. (1996). *Problem drinkers: Guided self-change treatment*. Guilford Press.

Sobell, M. B., & Sobell, L. C. (2000). Stepped care as a heuristic approach to the treatment of alcohol problems. *Journal of Consulting and Clinical Psychology*, *68*(4), 573–579.

Spanagel, R. (2009). Alcoholism: A systems approach from molecular physiology to addictive behavior. *Physiological Reviews*, *89*(2), 649–705.

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine*, *166*(10), 1092–1097.

Stockwell, T., Zhao, J., Panwar, S., Roemer, A., Naimi, T., & Chikritzhs, T. (2016). Do "moderate" drinkers have reduced mortality risk? A systematic review and meta-analysis of alcohol consumption and all-cause mortality. *Journal of Studies on Alcohol and Drugs*, *77*(2), 185–198.

Storbjörk, J., & Room, R. (2008). The two worlds of alcohol problems: Who is in treatment and who is not? *Addiction Research and Theory*, *16*(1), 67–84.

Sundström, C. (2017). *Therapist-guided internet treatment for alcohol use disorders*.

Sundström, C., Blankers, M., & Khadjesari, Z. (2017). Computer-based interventions for problematic alcohol use: a review of systematic reviews. *International Journal of Behavioral Medicine*, *24*(5), 646–658.

Sundström, C., Eék, N., Kraepelien, M., Fahlke, C., Gajecki, M., Jakobson, M., … Berman, A. H. (2019). High- versus low-intensity internet interventions for alcohol use disorders: results of a three-armed randomized controlled superiority trial. *Addiction*, add.14871.

Sundström, C., Gajecki, M., Johansson, M., Blankers, M., Sinadinovic, K., Stenlund-Gens, E., & Berman, A. H. (2016). Guided and unguided internet-based treatment for problematic alcohol use - A randomized controlled pilot trial. *PLoS ONE*, *11*(7).

Sundström, C., Kraepelien, M., Eék, N., Fahlke, C., Kaldo, V., & Berman, A. H. (2017). High-intensity therapist-guided internetbased cognitive behavior therapy for alcohol use disorder: A pilot study. *BMC Psychiatry*, *17*(1), 197.

Svanborg, P., & Åsberg, M. (2001). A comparison between the Beck Depression Inventory (BDI) and the self-rating version of the Montgomery Åsberg Depression Rating Scale (MADRS). *Journal of Affective Disorders*, *64*(2–3), 203–216.

Tansil, K. A., Esser, M. B., Sandhu, P., Reynolds, J. A., Elder, R. W., Williamson, R. S., … Fielding, J. E. (2016). Alcohol Electronic Screening and Brief Intervention. *American Journal of Preventive Medicine*, *51*(5), 801–811.

Tempier, R., Boyer, R., Lambert, J., Mosier, K., & Duncan, C. R. (2006). Psychological distress among female spouses of male at-risk drinkers. *Alcohol*, *40*(1), 41–49.

Tensil, M.-D., Jonas, B., & Strüber, E. (2013). Two fully automated web-based interventions for risky alcohol use: randomized controlled trial. *Journal of Medical Internet Research*, *15*(6), e110.

The Swedish National Institute of Public Health. (2009). *Resultatredovisning - undersökning allmänhet - Attitydundersökning ANTD vår 2009 [Presentation of results - survey of the general public - Attitude survey ANTD spring 2009]*.

Thomas, B. A., & McCambridge, J. (2008). Comparative psychometric study of a range of hazardous drinking measures administered online in a youth population. *Drug and Alcohol Dependence*, *96*(1–2), 121–127.

Trim, R. S., Schuckit, M. A., & Smith, T. L. (2013). Predictors of initial and sustained remission from alcohol use disorders: Findings from the 30-Year follow-up of the san diego prospective study. *Alcoholism: Clinical and Experimental Research*, *37*(8), 1424–1431.

Tuithof, M., ten Have, M., van den Brink, W., Vollebergh, W., & de Graaf, R. (2013). Predicting persistency of DSM-5 alcohol use disorder and examining drinking patterns of recently remitted

individuals: A prospective general population study. *Addiction*, *108*(12), 2091–2099.

Van Hout, B., Janssen, M. F., Feng, Y. S., Kohlmann, T., Busschbach, J., Golicki, D., … Pickard, A. S. (2012). Interim scoring for the EQ-5D-5L: Mapping the EQ-5D-5L to EQ-5D-3L value sets. *Value in Health*, *15*(5), 708–715.

Vasilaki, E. I., Hosier, S. G., & Cox, W. M. (2006). The efficacy of motivational interviewing as a brief intervention for excessive drinking: A meta-analytic review. *Alcohol and Alcoholism*, *41*(3), 328–335.

Velleman, R., & Templeton, L. J. (2016). Impact of parents substance misuse on children: an update. *BJPscyh Advances*, *22*(2), 108–117.

Verduin, M. L., LaRowe, S. D., Myrick, H., Cannon-Bowers, J., & Bowers, C. (2013). Computer simulation games as an adjunct for treatment in male veterans with alcohol use disorder. *Journal of Substance Abuse Treatment*, *44*(3), 316–322.

Verhoeks, C., Teunissen, D., van der Stelt-Steenbergen, A., & Lagro-Janssen, A. (2017). Women's expectations and experiences regarding e-health treatment: A systematic review. *Health Informatics Journal*, 146045821772039.

Verhulst, B., Neale, M. C., & Kendler, K. S. (2015). The heritability of alcohol use disorders: A meta-analysis of twin and adoption studies. *Psychological Medicine*, *45*(5), 1061–1072.

Vitesnikova, J., Dinh, M., Leonard, E., Boufous, S., & Conigrave, K. (2014). Use of AUDIT-C as a tool to identify hazardous alcohol consumption in admitted trauma patients. *Injury*, *45*(9), 1440–1444.

Wallace, P., Murray, E., McCambridge, J., Khadjesari, Z., White, I. R., Thompson, S. G., … Linke, S. (2011). On-line randomized controlled trial of an internet based psychologically enhanced intervention for people with hazardous alcohol consumption. *PLoS ONE*, *6*(3), e14740.

Wallace, P., Struzzo, P., Della Vedova, R., Scafuri, F., Tersar, C., Lygidakis, C., … Freemantle, N. (2017). Randomised controlled non-inferiority trial of primary care-based facilitated access to an alcohol reduction website. *BMJ Open*, *7*(11), e014576.

Wallhed Finn, S. (2018). *Alcohol dependence : barriers to treatment and new approaches in primary care*.

Wallhed Finn, S., Bakshi, A. S., & Andréasson, S. (2014). Alcohol consumption, dependence, and treatment barriers: Perceptions among nontreatment seekers with alcohol dependence. *Substance Use and Misuse*, *49*(6), 762–769.

Wallhed Finn, S., Hammarberg, A., & Andreasson, S. (2018). Treatment for Alcohol Dependence in Primary Care Compared to Outpatient Specialist Treatment—A Randomized Controlled Trial. *Alcohol and Alcoholism*, *53*(4), 376–385.

Walters, G. D. (2000). Behavioral self-control training for problem drinkers: A meta-analysis of randomized control studies. *Behavior Therapy*, *31*(1), 135–149.

Weiss, M. G., Ramakrishna, J., & Somma, D. (2006). Health-related stigma: Rethinking concepts and interventions. *Psychology, Health and Medicine*, *11*(3), 277–287.

West, R. (2006). Outline of a synthetic theory of addiction. University College London and Cancer Research UK.

Westman, J., Wahlbeck, K., Laursen, T. M., Gissler, M., Nordentoft, M., Hällgren, J., … Ösby, U. (2015). Mortality and life expectancy of people with alcohol use disorder in Denmark, Finland and Sweden. *Acta Psychiatrica Scandinavica*, *131*(4), 297–306.

White, A., Kavanagh, D., Stallman, H., Klein, B., Kay-Lambkin, F., Proudfoot, J., … Young, R. (2010). Online alcohol interventions: A systematic review. *Journal of Medical Internet Research*, *12*(5), e62.

WHO. (2018). *Global status report on alcohol and health 2018. Global status report on alcohol* (Vol. 65).

Wiers, R. W., Houben, K., Fadardi, J. S., Van Beek, P., Rhemtulla, M., & Cox, W. M. (2015). Alcohol

cognitive bias modification training for problem drinkers over the web. *Addictive Behaviors*, *40*, 21–26.

Witkiewitz, K., & Alan Marlatt, G. (2006). Overview of harm reduction treatments for alcohol problems. *International Journal of Drug Policy*.

Witkiewitz, K., Bowen, S., & Donovan, D. M. (2011). Moderating effects of a craving intervention on the relation between negative mood and heavy drinking following treatment for alcohol dependence. *Journal of Consulting and Clinical Psychology*, *79*(1), 54–63.

Witkiewitz, K., Donovan, D. M., & Hartzler, B. (2012). Drink refusal training as part of a combined behavioral intervention: Effectiveness and mechanisms of change. *Journal of Consulting and Clinical Psychology*, *80*(3), 440–449.

Wood, A. M., Kaptoge, S., Butterworth, A., Nietert, P. J., Warnakula, S., Bolton, T., … Thompson, S. (2018). Risk thresholds for alcohol consumption: combined analysis of individual-participant data for 599 912 current drinkers in 83 prospective studies. *The Lancet*, *391*(10129), 1513–1523.

World Health Organisation. (1992). *The ICD-10 classification of mental and behavioural disorders: clinical descriptions and diagnostic guidelines*. Geneva: World Health Organization.

Wright, F. D., Beck, A. T., Newman, C. F., & Liese, B. S. (1993). Cognitive therapy of substance abuse: theoretical rationale. In L S Onken, J. D. Blaine, & J. J. Boren (Eds.), *Behavioral Treatments for Drug Abuse and Dependence* (Vol. 137, p. 123). National Institute on Drug Abuse.

Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, *67*(6), 361–370.